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# ANALYTICAL COMPENDIUM

OF

# MEDICAL SCIENCE.

AN

# ANALYTICAL COMPENDIUM

OF THE

# VARIOUS BRANCHES

OF

# MEDICAL SCIENCE,

FOR THE

## USE AND EXAMINATION OF STUDENTS.

BY

JOHN NEILL, M.D.,

SURGEON TO WILLS' HOSPITAL, DEMONSTRATOR OF ANATOMY IN THE UNIVERSITY OF PENNSYLVANIA, LECTURER ON ANATOMY IN THE PHILADELPHIA MEDICAL INSTITUTE, FELLOW OF THE COLLEGE OF PHYSICIANS, ETC.,

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SECOND EDITION, REVISED AND IMPROVED.

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# PREFACE

## TO THE SECOND EDITION.

THE speedy sale of a large impression of this work has afforded to the authors gratifying evidence of the correctness of the views which actuated them in its preparation. In meeting the demand for a second edition, they have therefore been desirous to render it more worthy of the favour with which it has been received. To accomplish this, they have spared neither time nor labour in embodying in it such discoveries and improvements as have been made since its first appearance, and such alterations as have been suggested by its practical use in the class and examination-room. Considerable modifications have thus been introduced throughout all the departments treated of in the volume, but more especially in the portion devoted to the "Practice of Medicine," which has been entirely rearranged and rewritten. The authors therefore again submit their work to the profession, with the hope that their efforts may tend, however humbly, to advance the great cause of medical education.

PHILADELPHIA, December, 1851.

standard text-books of the day, gleaning from them whatever seemed useful to their purposes, even in some instances employing their language as well as ideas. They also acknowledge, with pleasure, the valuable assistance afforded them in the Departments of Materia Medica and Chemistry, by Dr. Reese, Lecturer on Materia Medica and Therapeutics in the Medical Institute of Philadelphia.

In preparing this Compendium, the ordinary form of question and answer has been avoided, as incompatible with the character designed for it, and as occupying, with meagre questions, space that might be more advantageously employed. It is hoped that the arrangement adopted will be found at once concise and intelligible, while the authors feel assured that the mechanical execution of the work, its copious illustration, and neat, cheap, and convenient form, will prove all that can be desired by the student and practitioner.

PHILADELPHIA, August, 1848.

A

# HAND-BOOK

OF

# ANATOMY.

A

# HAND-BOOK

OF

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## With One Hundred and Fifty-Nine Illustrations.

BEING A PORTION OF

AN ANALYTICAL COMPENDIUM

OF THE

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# ANATOMY.

*Anatomy* is the science which investigates the structure and organization of living beings.

*Special Anatomy* or *Descriptive Anatomy* is the consideration of each organ or part of the human body, including its size, weight, colour, shape, &c.

*General Anatomy* investigates the different tissues or structures out of which organs are formed.

*Surgical Anatomy* or *Regional Anatomy* is the study of the relation of one part to another, and is one of the most important applications of anatomy to the practice of medicine and surgery.

*Physiological Anatomy* considers the uses and functions of organs in a healthy state.

*Pathological Anatomy* regards the different organs altered by disease.

This is a compendium principally of special anatomy; and is divided into seven sections:

1. Bones.
2. Ligaments.
3. Muscles.
4. Viscera.
5. Vessels.
6. Nerves.
7. Special Senses.

# SECTION I.

## BONES.

### GENERAL CONSIDERATIONS OF BONE.

THE bones of the *skeleton* are two hundred and eleven in number, of which twenty-two belong to the head, fifty-six to the trunk, sixty-nine to the superior and sixty-four to the inferior extremity; when held together by ligaments and cartilages they form a natural skeleton, when by other means an artificial skeleton. They are hard, white, and inflexible; and more numerous in childhood than in old age.

They are *classified* into long, thick, and flat bones. The body or shaft of a long bone is called Diaphysis; its articulating extremities, Epiphyses; its processes and projections are called Apophyses. The small foramina on the surface of bones are for the transmission of nutritious vessels, the largest of which enters about the middle.

Bones are composed of two *structures, compact* and *cellular*. The compact structure consists of small fibres arranged in laminæ; each of these fibres has a canal running through its length, called the canal of Havers, transmitting vessels; it communicates with small lenticular excavations, called *corpuscles of Purkinje*, by radiating tubes. The cellular structure increases the volume and strength without increasing the weight, and also diminishes the effect of concussion. The cells communicate with each other, and contain marrow.

*Composition of Bones.*—Bones are chemically composed of animal and earthy matters, united in the proportion of two parts of earthy to one of animal. By the analysis of Berzelius, they consist of thirty-two parts of gelatine, one part of insoluble animal matter, fifty-one parts of phosphate of lime, eleven of carbonate of lime, two of fluate of lime, one of phosphate of magnesia, and one of soda and muriate of soda. The earthy matter is most abundant in bones of the cranium: the animal matter in the cellular structure. Combustion will remove the animal matter, and dilute acids will remove the earthy matter.

The *Periosteum* is a white fibrous membrane investing the external surface, adhering less firmly in infancy, and becoming ossified in old age. It is vascular, insensible in health, assists in the secretion of the external laminæ, restrains ossification within proper limits, receives the insertion of muscles, tendons, &c. and protects the bone from suppuration in the vicinity.

*Marrow* is contained in a fine vascular membrane, lining the medullary canals and cells of bones, called the *Internal Periosteum.* It resembles fat, but consists of finer granules; in consumption, dropsy, &c., it is absorbed and its place is supplied with serum.

*Formation and growth of bones.*—There are three stages of ossification in the embryo. The first is the mucous or pulpy, which continues for one month; the second is the cartilaginous, and the third the osseous, commencing at the third month. The colour of the cartilage deepens and then a vessel conveys red blood to a central point, which first receives calcareous particles and is called *punctum ossificationis.* Bones increase in length by continued deposit at their extremities between the Diaphysis and the Epiphyses, as is proved by Hunter's experiment of placing two shot in the tibia of a young pig; after the animal had reached full size, the shot were found at their original distance from each other. Bones increase in thickness by external deposit and by secretion from the periosteum, which is proved by disease and the experiment of feeding a young pig with food coloured with madder. Various laminæ of white and coloured bone can be produced by suspending and resuming this mode of feeding. While deposit is taking place upon the surface of a bone, absorption is going on internally; this is proved by Duhamel's experiment of surrounding a long bone of a young animal with a metallic ring; after the animal was fully grown, the ring was found in the medullary canal, which increases in size by this constant deposit and absorption.

*Callus.*—When bones are fractured, the process of reparation resembles that of the formation of a bone. Blood is effused, and lymph is thrown out, causing a swelling. Afterwards the blood is absorbed and the lymph becoming cartilage ossifies in the form of a ring, which surrounds the seat of fracture, and also in the form of a pin in the medullary canal.

After the fractured extremities have united, the superfluous ring and pin of bone which acted as splints are absorbed. Whilst this process is going on, it is important that the parts should be maintained at rest, otherwise the process of ossification is arrested, and a false joint results.

## BONES OF THE TRUNK.

The trunk consists of the Spine, Pelvis, and Thorax.

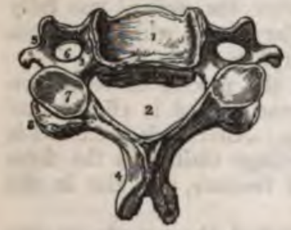
### SPINE.

It extends from the head to the coccyx at the posterior part of the trunk, having several curvatures. In the neck it is convex anteriorly, in the thorax concave, in the loins convex, and in the pelvis concave. It contains an osseous canal for the spinal marrow, and is formed of 28 or 29 separate bones, called *vertebræ*, 24 of which are classified as *true vertebræ*, on account of their mobility, and the 5 remaining are called *false vertebræ*. The true vertebræ are divided into 7 *cervical*, 12 *dorsal*, and 5 *lumbar;* the false vertebræ consist of the sacrum, and 3 or 4 coccygeal bones.

A vertebra consists of a body, 7 processes, and a spinal foramen. The *body* is in front, and is the thickest part; it supper and lower surfaces articulate with a contiguous vertebra by means of a cartilage; it is convex anteriorly from side to side. The *processes* are, one *spinous*, of a triangular shape, and situated behind for the attachment of muscles; two *transverse*, one projecting horizontally on either side for the attachment of muscles and ligaments; and four *oblique* processes, two of which are superior and two inferior, which are for the purpose of articulation. The *spinal foramen* is in the middle, and constitutes a portion of the spinal canal. The *intervertebral foramen* is formed on each side by a groove upon the upper and lower surface of each vertebra, and transmits a spinal nerve.

## CERVICAL VERTEBRÆ.

Fig. 1.



The *bodies* are small, and flattened in front; the superior surfaces[1] are concave laterally, the inferior are concave antero-posteriorly; they gradually increase in size. The *spinous processes*[4] are short, thick, horizontal, and bifid. The *oblique processes* are flat, oval, and short; the *superior*[7] look upwards and backwards, and the *inferior*[8] downwards and forwards at an angle of forty-five degrees. The *transverse processes*[5] are broad, perforated at their base by a foramen[6] for the transmission of the vertebral artery. The *spinal foramen*[2] is very large and triangular.

The *first cervical vertebra* is called the *atlas;* it has no body, and resembles a ring. In place of a body, there is an arch which has a tubercle in the middle of its anterior surface; in the corresponding part of its posterior surface is an articular fossa for the *processus dentatus* of the second vertebra. The posterior arch has a tubercle instead of the spinous process. The *superior oblique processes* are large, oblong, and concave, adapted to the condyloid processes of the occiput; and admit of flexion and extension. The *inferior oblique processes* are round, flat and horizontal, adapted to the rotatory motion of the head. The transverse process is extremely long. On the inner side of the oblique processes is a tubercle for the attachment of the transverse ligament. It has the largest *spinal foramen.*

The *second* cervical vertebra is called *dentata,* from its tooth-like process projecting from the upper surface of the body; the tip of which is rough for the middle straight ligament, and on the sides of the tip there is a flatness for the attachment of the moderator ligaments. This process is smooth in front where it touches the arch of the atlas and also behind where the transverse ligament plays. Upon this process the head rotates. The *superior oblique process* is circular and slightly convex. The *spinous* process is long and bifid.

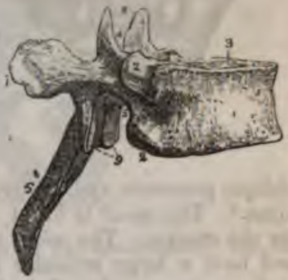
The *sixth* has a long and pointed *spinous* process.

The *seventh* is the largest and resembles a dorsal. The spinous process is the longest and tuberculated. The foramen at the base of the transverse process does not transmit the vessels.

### DORSAL VERTEBRÆ.

These are twelve in number. The *bodies*[1] are cylindrical, and their transverse diameter decreases from the first to the third, and then increases. The upper and lower surfaces are flat, and the sides have articular marks[2] for the heads of the ribs. Each fossa is formed by two contiguous vertebræ. The *oblique* processes are vertical, the superior[8] looking backwards and the inferior[9] looking forwards. The *transverse* processes[7] are long, and their extremities are enlarged; in front there is an articular face for the tubercle of the rib. The *spinous* processes[5] are long and triangular, broad at the base, sharp-pointed and overlap each other. The spinal foramen is small and round. The intervertebral foramen is mainly formed by the inferior groove,[5] which is much deeper than the superior.[4]

Fig. 2.

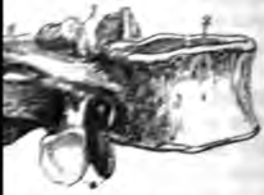


The *first* has a complete fossa for the head of the rib upon its side. The *eleventh* and *twelfth* have also complete fossæ for the heads of the ribs. Their transverse processes are short, directed backwards, and do not articulate with the ribs.

### LUMBAR VERTEBRÆ.

Their number is five. The *bodies* are large and oval, the trans-

Fig. 3.



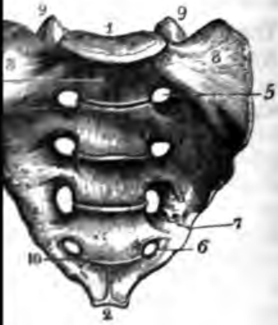
verse diameter being the longest. The spinal foramen is triangular and large. The grooves[3,4] forming the intervertebral foramen are also large. The *oblique* processes are vertical; the superior[7] looking inwards and the inferior[8] looking outwards. The *transverse* processes[6] are long and at right angles. The *spinous*[5] processes are short, quadrangular, and horizontal.

*first* is the smallest; the *third* has the longest transverse
; the *fifth* has a wedge-shaped body.

## SACRUM.

riangular, and originally consisted of five pieces; its *anteri*
*surface* is concave, and has f
funnel-shaped holes[4,6] on e
side, transmitting the ante
branches of the sacral ner
Its *posterior surface* is rougl
convex, and contains the
sentations of spinous and
processes. A fissure
exists in place of the fo
fifth spinous processe
are four foramina on
smaller than those in
the transmission of th
branches of the ner
*base* has a large ov
mark[1] upon which
lumbar vertebra;

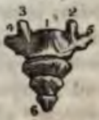
Fig. 4.



e processes, and two grooves completing the inte
The *apex*[2] is blunt and has a transverse art
coccyx. The *sides* are rough, broader abov
ave a large articular mark for the innominat
arise muscles of the back, and below it the
The *sacral canal* runs through the lengt
triangular, larger above than below;[6] and
inal canal. It contains the cauda equina;
ate the foramina transmitting the nerves.

consists of three or four bones united usually in the same curve as that of the sacrum. The pieces are frequently united with each other and the sacrum.

Fig. 5.



The *first* piece is the largest, and has two articular marks; behind, it has two *cornua*;[2] [3] on its side are grooves,[4] [5] which with the sacrum complete the canal for the fifth sacral nerve. The *last piece*[6] is a mere tubercle. The sides of the coccyx give origin to muscles and ligaments.

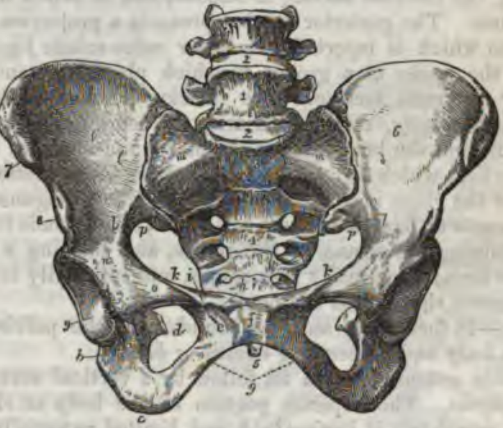
## PELVIS.

The pelvis consists of the *sacrum*, *coccyx*, and the *two innominata* or hip bones.

### INNOMINATUM.

This is a large flat bone forming the haunch or hip of common language, resembling in some measure the figure 8. In youth it consists of three different parts, united in the acetabulum, viz. the ilium, ischium, and pubes.

Fig. 6.



*Ilium.*—This is the largest piece, and forms the wall of the upper pelvis. Its *external* surface is convex and rough, with a semicircular ridge crossing it; above this ridge arises the gluteus medius, and below it the gluteus minimus muscle; the posterior part of this surface is the roughest, and gives origin to the gluteus maximus.

The anterior part of the internal surface[6] contains a large, smooth concavity called the costa, which gives origin to the iliacus internus;

the posterior is rough and has a large articular mark for the sacrum, behind which arise muscles and ligaments. The *edge* or *crista* is arched and curved like the italic *f*. In front there are two eminences, one of which is called the *anterior superior spinous process*,[7] giving origin to the sartorius and tensor vaginæ muscles and Poupart's ligament; the other is the *anterior inferior spinous process*,[8] and gives origin to the rectus muscle; the space between the two gives origin to the gluteus medius. Below these processes is a large prominence[a] called *ilio-pectineal;* in the groove above this passes the iliacus internus and psoas magnus muscles. The posterior *superior* and *inferior spinous* processes are behind, and to them are attached ligaments. The *crista* has three lips, from the internal of which arises the transversalis muscle, from the middle arises the internal oblique, and into the external is inserted the external oblique. The inferior border of the ilium presents a *notch*,[p] called *sciatic*.

*Ischium.*—This is the most inferior part of the innominatum. It consists of a body and a branch; the external surface of the body[b] is rough; the internal surface is smooth, and is called the *plane* of the ischium. The posterior border presents a projection called the *spine*, into which is inserted the lesser sacro-sciatic ligament, and beneath the spine is a groove in which plays the tendon of the obturator internus muscle. The inferior portion of the body is called the *tuberosity*,[c] from which arise the semi-membranosus, semi-tendinosus, and the long head of the biceps muscles; in front there is a ridge into which is inserted the greater sacro-sciatic ligament; outside of the ridge is the origin of the adductor magnus muscle.

The *ramus* or branch is short and thick, and ascends forward and inward, joining the ramus of the pubes, and forming a portion of the pubic arch;[9] externally it is rough, and internally it is smooth, whence arises the crus of the penis.

*Pubes.*—It forms the anterior boundary of the pelvis,[e] and consists of a *body* and descending *ramus* or *branch*.

The *body* articulates with its fellow by a vertical surface,[f] called the *symphysis*. The superior portion of the body at right angles with the symphysis is *horizontal*,[h] and limited externally by a projection[i] called the *spinous process;* from this process there diverge two ridges; the posterior[k] is sharp and called the *crista of the pubes*, or *linea pectinea;* to it is attached a portion of Poupart's and Hey's ligament. Between these ridges is included a triangular space,[o] the base being the ilio-pectineal eminence,[a] and the apex of the spinous process; from this space arises the pectineus muscle, and over it pass the femoral vessels. The anterior ridge terminates at the acetabulum.

The *ramus* descends to join that of the ischium, and forms a part of the pelvic arch; externally it is rough for the origin of the abductor muscles; internally it is smooth, and from it arises the crus of the penis.

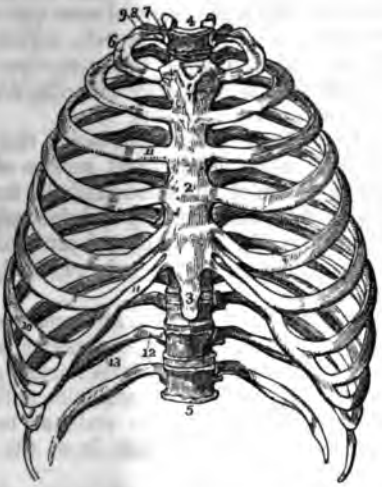
The *acetabulum*,[9] is a deep hemispherical concavity upon the outer side of the bone for the articulation of the head of the femur. The brim of this cavity is notched on the lower edge. In the bottom of the cavity is a rough depression occupied by a mass of fat, commonly called a gland of Havers. Immediately beneath the acetabulum is a groove, in which plays the tendon of the external obturator muscle.

The *obturator* or *thyroid foramen*, is that large opening in the front and lower part of the bone, which is filled up by a membranous ligament, with the exception of a groove at its upper part, through which pass the obturator vessels and nerve. Its shape is oval in males, but triangular in females.

## THORAX.

This cavity is formed by the dorsal vertebræ, ribs and sternum; its figure is conoidal, flattened in front, and concave behind; the apex presents a cordiform opening, and the opening at the base has a large notch in front.

Fig. 7.



### STERNUM.

Is an oblong, slightly-curved bone, placed in front of the thorax. Usually it consists of three pieces, but in advanced life of but one.

The *first* or superior bone,[1] is the thickest, and resembles in shape a triangle, with the corners cut off, the base being upwards; on the superior edge is a concavity for the benefit of the movements of the trachea; on each side is a large concavity for the articulation of the clavicle, and below are two smaller ones for the articulation of the first and part of the second rib.

Sometimes there are found upon the upper edge of the first bone two small spherical bones called *Episternal bones*.

The *second* bone[2] is longer and narrower than the first, increasing in breadth in its lower extremity; its sides present pits for the articulation of part of the second, the third, fourth, fifth, sixth, and part of the seventh ribs.

The *third* bone,[3] is very frequently cartilaginous, and called xyphoid or ensiform; its shape varies, sometimes being pointed, and sometimes bifurcated; upon its side is a depression for a portion of the seventh rib.

## RIBS.

These are twenty-four in number, twelve on either side; those that articulate with the sternum are called *true* ribs, and are seven in number; the five below them are called *false* ribs: in some rare instances there have been thirteen or eleven ribs on one side. They are parallel, and directed obliquely downwards and forwards; each having a parabolic curve, and gradually increasing in size until the eighth, afterwards gradually diminishing.

The *anterior* or *sternal* extremity is larger and flatter than the *posterior;* the *posterior* or *vertebral* extremity presents a spherical head, having two articular surfaces separated by a ridge. The *neck* of the rib is very narrow and its upper edge, which is sharp, has inserted into it the *internal costo-transverse* ligament; about one inch from the head is the tubercle, a prominence with an articular face, for articulation with the transverse process of the vertebra; just beyond this is a smaller tubercle, for the insertion of the *external costo-transverse* ligament.

Each rib is twisted and bent; this bend constitutes the *angle* of the rib; upon the external surface of the angle is a mark showing the insertion of the sacro-lumbalis muscle. The *lower* edge of the rib is thin and cutting, and just within it is a groove,[13] running two-thirds of its length, and containing the intercostal vessels and nerve. The *upper* edge is rounded, and upon it are inserted the intercostal muscles.

The *first* rib is small and semicircular, its surface looking superiorly and inferiorly; the superior surface has upon its middle a slight fossa, for the subclavian artery; in front of this is a roughness for the insertion of the scalenus anticus muscle, behind it another for the insertion of the scalenus medius; the head has a single articular surface, its angle is at the tubercle, and it has no intercostal groove.

The *eleventh and twelfth,*[12] are called *floating* ribs, because they are not connected with the others; they have no tubercles, and their heads have but a single articular surface. The twelfth is very short, but slightly curved, and has no intercostal groove.

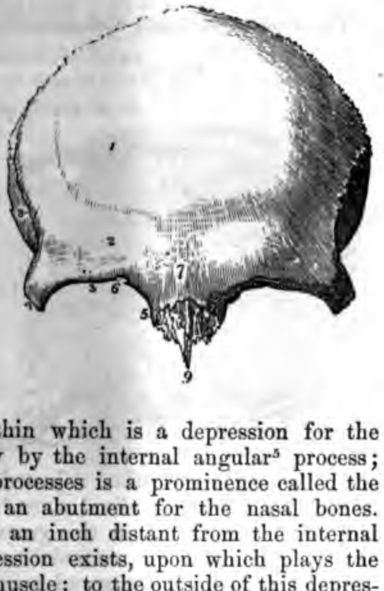
## BONES OF THE HEAD.

These are twenty-two in number, and are divided into those of the cranium, which are eight in number; and those of the face, which are fourteen.

### CRANIUM.

#### FRONTAL BONE.

Fig. 8.



This forms the forehead. It is usually a single, symmetrical bone, though occasionally divided by a suture into two parts. Its shape resembles that of a shell.

The *external surface* is convex, and about the middle upon each side there is the *frontal protuberance*,[1] being the original centre of ossification; below this and nearer the median line is an oblique ridge called the *nasal* or *superciliary protuberance*.[2] The inferior edge of the bone is formed on either side by the *orbitary ridge*,[3] forming the superior boundary of the orbit of the eye; this ridge is terminated outwardly by the external angular process,[4] just within which is a depression for the lachrymal gland, and inwardly by the internal angular[5] process; between the internal angular processes is a prominence called the *nasal spine*,[9] which serves as an abutment for the nasal bones. Upon this orbitary ridge, half an inch distant from the internal angular process, a small depression exists, upon which plays the tendon of the superior oblique muscle; to the outside of this depression is a notch or foramen, for the transmission of the supra-orbital artery and nerve.[6]

The *frontal sinus*[7] opens near the internal angular process, and is formed by the separation of the tables over the orbitary ridge; its capacity varies, and there are no means of determining it in the living being; it empties into the infundibulum of the ethmoid.

The *internal surface* is concave and has numerous depressions corresponding with the convolutions of the brain; in the middle is a fossa for the superior longitudinal sinus, and a ridge for the attachment of the dura mater; at the bottom of this ridge is the *foramen*

, transmitting a vein, which forms the commencement of

e *orbitar processes* are two horizontal plates, forming the ro e orbits, separated by a large space, which is occupied by oid bone. The *internal* edges of these processes have t ves, which are converted into foramina, called ethmoidal tary, by the articulation of the ethmoid. Each transmits ery and a vein to the nose. The *anterior ethmoidal foram* o transmits the internal nasal nerve.

Laterally the bone articulates with the parietal and sphenoid riorly with the bones of the face and with the ethmoid.

### PARIETAL BONES.

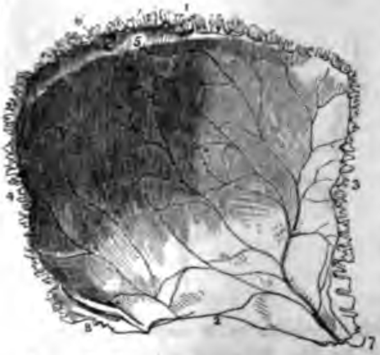


Fig. 9.

These occur in pairs, and form the middle and lateral port the cranium; they ar rangular.

The *external* su convex, has in its mi parietal protuberanc tre of ossification; is the semicircular cating the attachm temporal fascia an

The *internal su* cave, with nume sions for the co the brain, and versed by furr the course of t tery of the du *superior* edge[1] and much dentated; when adjusted with its fellow, groove for the longitudinal sinus.[5] The parietal mitting a vein, opens in this groove. The *inferi* concave, and squamous, articulating with the tem rior inferior angle[7] is long and pointed, articulati wing of the sphenoid; the posterior inferior[8] a and deeply grooved on its internal surface for th

### OCCIPITAL BONE.

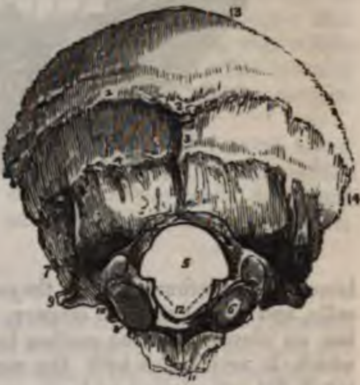
the trapezius and occipital frontalis. About one inch below is another semicircular ridge[4] for the insertion of the superior oblique muscle. Between this ridge and the foramen magnum, the space is occupied by the recti postici muscles. Reaching from the external occipital cross is a vertical ridge[3] extending to the foramen magnum, to which is attached the ligamentum nuchæ. The space between the superior and inferior semicircular ridges is occupied by the insertion of the splenius and complexus muscles.

The *foramen magnum*[5] is oval, its antero-posterior diameter being the largest; it transmits the medulla oblongata, spinal accessory nerves, and vertebral artery. On either side of the foramen is the *condyloid process*,[6] an oblong convex surface converging towards its fellow, and articulating with the atlas. It is frequently divided by a ridge or groove, especially in the young African head. The *anterior condyloid foramen*[8] transmits the hypoglossal or ninth nerve, the *posterior condyloid foramen*[7] a vein to the lateral sinus.

In front of the foramen magnum is the *basilar process*,[11] the extremity of which articulates with the sphenoid; the inferior surface receives the insertion of the recti postici and superior constrictor muscle of the pharynx; the superior surface is concave and contains the medulla oblongata.

The *internal surface* is concave and about its middle has an *internal occipital* cross, which is more prominent than the external; from it there diverge three grooves, containing the two lateral and the superior longitudinal sinuses; inferiorly there proceeds a ridge to the foramen magnum to which is attached the falx cerebelli. The concavity is thus divided into four smaller ones; the two superior, containing the posterior lobes of the cerebrum, and the two inferior the hemispheres or lobes of the cerebellum.

Fig. 10.

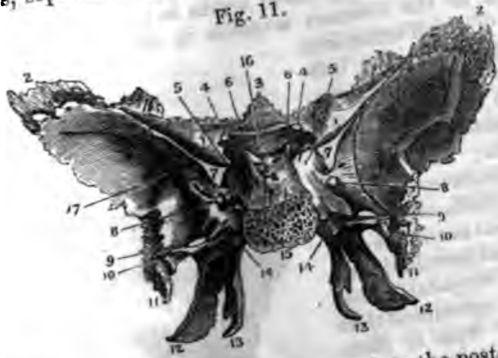


The two superior edges are deeply dentated and articulate with the parietal; the two inferior articulate with the temporal. On each inferior edge is a prominence called the *jugular eminence*,[9] in front of which is a fossa converted into the *posterior foramen lacrum*[10] by articulation with the temporal, through which pass the internal jugular vein and the eighth pair of nerves. Upon the inferior surface of this eminence is inserted the rectus capitis lateralis.

### SPHENOID.

ed in the middle and anterior part of the base of the cra-
The shape resembles a bat; consists of a body and four
large and small one being placed on each side, besides two
processes directed downwards.
body is in the centre and cuboidal in its shape. On its *supe-*
rface is a deep pit called *sella turcica*,[16] which contains the
ry gland. This depression is overhung posteriorly by the
or *clinoid process*;[8] on either side are two grooves called *sulci*
i, for the carotid arteries, and in front there is a prominence
*processus olivaris*, upon which is a transverse groove indicating
osition of the chiasm of the optic nerves.
the anterior view of the body are the orifices of the two sphe-
l cells, separated by a ridge, upon which articulates the nas

Fig. 11.



lamella of the ethmoid bone; they empty into the poste
cells, and do not exist in infancy. The inferior surf
has an elevation in the median line called the *proce*
which it articulates with the vomer. Posteriorly,
rough for articulating with the cuneiform process
bone.

The *small wings*[1] are n front of the larg
angular, flat, and na eir posterior extr
the anterior clinoid , which are perfo
*foramina*,[4] through optic ner
artery. They artic h the fron
The great wings a om the sma
*fissure* or *foramen*,[7] nsmits the third
of the fifth, and the
This wing has three

cerebrum which lodges in this concavity. It has three foramina. The foramen *rotundum*[8] transmits the second branch of the fifth pair. Behind it, is the *foramen ovale,*[9] through which passes the third branch of the fifth pair. The posterior angle of this surface is the spinous process, which is perforated by the *foramen spinale,*[10] by which the middle artery of the dura mater enters the cranium. Projecting from the inferior surface of this process is another called *styloid,*[11] which gives origin to muscles.

The external surface is the *temporal,* which is divided by a ridge, and has a process in front; it is covered by the temporal and external pterygoid muscles. The *anterior* surface is called the *orbital,* forming a large portion of the orbit of the eye. On the superior surface is a large, triangular, serrated surface, for articulating with the frontal bone; laterally it articulates with the temporal.

*Pterygoid processes.*—These project downwards on either side in a line parallel to the facial line, and articulate with the palate bones in front. Posteriorly, there is a fossa called pterygoid, which terminates in a notch, and divides the process into an *external* and *internal plate.* The *external*[12] is the broader, and gives origin to the external pterygoid muscle; the *internal*[13] is the longer, and terminates in a hook-like process, called the *hamulus,* over which plays the tendon of the circumflexus palati muscle. The internal plate gives origin to the internal pterygoid muscle, which occupies a portion of the fossa.

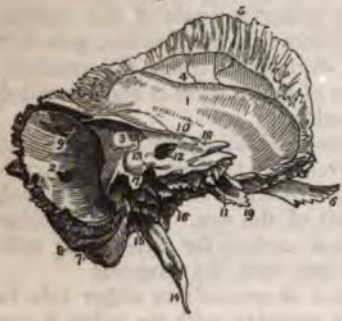
The internal surface of the base of the pterygoid process has a groove upon it, showing the course and connexion of the cartilaginous portion of the Eustachian tube. The *pterygoid foramen*[14] perforates the base of the process, and transmits the vidian or recurrent nerve.

### TEMPORAL BONES.

These are placed on either side of the cranium below the parietal bone. They consist of three portions, squamous, petrous, and mastoid.

The *squamous*[1] is thin and shell-like. Its *external* surface is slightly convex, has grooves for the deep temporal artery, and is covered by the temporal muscle. Projecting anteriorly from the lower part of this surface is the *zygomatic process,*[6] which forms a part of the zygomatic arch. The base of this process is triangular, and has beneath it a cavity called glenoid for the articulation of the lower jaw. This cavity is separated by the Glaserian fissure from another behind it, containing a portion of the parotid gland. Through this fissure pass the chorda tympani nerve and the laxator tympani muscle, attached to the processus gracilis of the malleus. The *internal surface* has a distinct groove[4] for the middle artery of the dura mater. The edge is thin and cutting and has flat serrations[5] for the parietal bone.

Fig. 12.



The *mastoid*[2] portion is behind, and nipple-like. It is thick and cellular; the cells being lined by a thin membrane. Externally it is rough, and has a large *process* called *mastoid*, upon which are inserted the sterno-cleido-mastoid and trachelo-mastoid muscles. Beneath this process is the *digastric fossa*,[7] which gives origin to the digastric muscle. Internally is a deep sulcus[8] containing a part of the lateral sinus. The edges are thick and dentate. Near the upper edge is the mastoid foramen,[2] which transmits a vein.

The *petrous*[3] portion is pyramidal and directed obliquely forwards and inwards. Its structure is extremely dense.

The *base* has a large oval opening externally, between the zygomatic and mastoid, called the *external meatus*, which is surrounded by a rim called the *auditory* process, to which is attached the cartilaginous portion of the ear. In the fœtus it is a ring. The *apex* is obtuse and is perforated by the carotid canal. In the angle between the apex and the squamous portion, is the bony portion of the Eustachian tube, and above it a canal for the tensor tympani muscle.

The *inferior surface* presents a large process, *styloid*,[14] projecting from a ridge called *vaginal process*. Behind it, is the *stylo-mastoid foramen*,[15] the orifice of the Fallopian canal, which transmits the facial nerve and stylo-mastoid artery. Inwards from the styloid process is the *jugular* fossa, which is converted into the posterior foramen lacerum by the articulation of the occipital bone; this foramen transmits the internal jugular vein and the eighth pair of nerves. The *tympanic canal*, containing Jacobson's nerve, opens in this fossa; its other orifice is near that of the Eustachian tube. In front of the jugular fossa is the commencement of the *carotid canal*,[16] which contains the carotid artery and the ganglion of Laumonier. Upon the septum between the jugular fossa and carotid canal, is the entrance to the *aqueduct of the cochlea*.

The anterior surface presents a groove leading to a foramen called hiatus Fallopii, which transmits the superficial petrous nerve, a branch of the vidian; behind this is the *eminentia arcuata*, made by the prominence of the labyrinth. At the internal edge is a groove for the superior petrosal sinus, and near the apex a semilunar depression for the ganglion of Casser.

The *posterior* surface has a large opening near the middle, *internal meatus auditorius;* it is not deep, and the base is cribriform. Immediately above it is a foramen or fissure for the attachment of the dura mater and a small vessel; behind it is a ridge produced by the inferior semicircular canal, and half an inch behind it is the aqueduct of the vestibule, concealed by an osseous lamella.

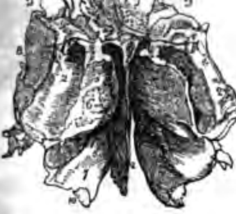
### ETHMOID.

Is so called from its resemblance to a sieve. It is placed in the median line, at the base of the skull, in front of the sphenoid bone, and between the orbitar processes of the frontal. Is cuboidal in shape and cellular in structure.

The *superior* surface is called the *cribriform plate,*[4] which is perforated with holes for the transmission of filaments of the olfactory nerve; the most anterior hole is the largest, and transmits the internal nasal nerve. From the median line is a narrow, triangular, hollow process called the *crista galli,*[3] and to it is attached the falx cerebri. In front of this is sometimes the foramen or groove called foramen cæcum, which admits of the passage of a small vein from the nose.

The bone is divided longitudinally into two halves by the vertical plate of bone called the *nasal lamella;*[1] this can best be seen by examining the inferior surface. It articulates below with the vomer, and behind with the crista sphenoidalis.

Fig. 13.



The *lateral surfaces* of the bone are called the *ossa plana.* The os planum is extremely thin and papyraceous, forming a large part of the orbit of the eye. On its upper edge are two grooves, which are converted into two *foramina,* called *internal orbitary* or *ethmoidal;* the anterior transmits an artery, vein, and the internal nasal nerve; and the posterior transmits an artery and vein. The inferior edge articulates with the superior maxillary bone. When the bone is viewed from behind there will be seen two scrolls or shells on either side of the nasal lamella, but attached to the internal face of the os planum. They are the *superior*[6] and *middle turbinated bones,*[7] placed one above the other, and separated by a fissure. This fissure is the *superior meatus*[6] of the nose. The middle meatus is a space observed in an articulated head between the middle and inferior turbinated bones. The anterior cells of the ethmoid bone empty into the middle meatus; the most anterior of these cells is funnel-shaped (*infundulum*), and receives the fluid from the frontal sinus; from the inferior part of these cells there proceeds a hook-like process. The posterior ethmoidal cells and the sphenoidal sinus empty in the superior meatus.

In children there is attached to the ethmoid bone, on each side, a hollow triangular process, called the pyramid of Wistar, or cornu Bertini. The base is connected with the superior turbinated bone, the posterior edge of the cribriform plate, and the posterior edge of nasal lamella. The apex lies under the body of the sphenoid bone, on each side of the processus azygos. These pyramids are detached from the ethmoid in after life, and become the sphenoidal sinuses.

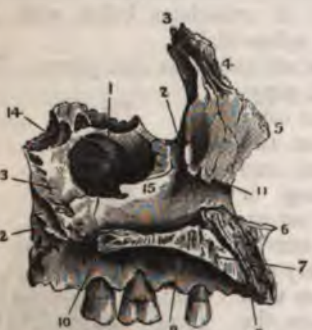
The ethmoid articulates with the frontal, sphenoid, inferior turbinate, upper jaw, nasal, lachrymal, palate bones, and vomer.

## BONES OF THE FACE.

These are fourteen in number, and exist in pairs with the exception of two, the lower jaw and the vomer.

### SUPERIOR MAXILLARY BONE.

Fig. 14.



This with its fellow constitutes the upper jaw. It articulates with all the bones of the face with the exception of the lower jaw. It has an irregular cubical body and four processes. The *body* is hollow and has four surfaces.

The anterior or *facial* surface is bounded above by the inferior margin of the orbit, beneath which is the *infra-orbital foramen*, transmitting the infra-orbital nerve, artery, and vein. Contiguous to this foramen is a depression, called the canine fossa, which gives origin to the levator anguli oris muscle. The posterior or *temporal* surface is rounded. The most prominent part is called the *tuber*,[12] which is rough and perforated by several small foramina which transmit the posterior dental nerve, artery, and vein, to the floor of the antrum.

The superior or *orbital surface* is triangular, and traversed by the infra-orbital groove leading to the foramen of that name. Upon the internal or *nasal surface* is the large opening of the *antrum Highmorianum*,[1] which is a pyramidal cavity with thin walls; the walls are grooved, indicating the passage of the anterior and posterior dental nerves. The opening is diminished by the articulation of the palate, inferior turbinate, and unguiform bones, to a small orifice which opens into the middle meatus of the nose.

The *nasal process*[4] arises from the superior and anterior part of the bone. It is broad and thin below; externally it gives origin to the levator labii superioris alæque nasi muscle, internally it has a transverse ridge dividing the surface unequally for the inferior turbinated bone. The anterior edge articulates with the nasal bone, the superior with the frontal, and the posterior edge has a deep groove, which is converted into a bony canal for the lachrymal sac by the articulation of the os unguis.

The *malar process* is a rough process upon the external and superior part of the bone for articulation with the malar bone.

The *alveolar process* contains the sockets for eight teeth.

The *palate process*[7] is the horizontal roof of the mouth and floor of the nose; uniting behind with the horizontal part of the palate bone,[10] and on the side with its fellow, from which latter junction or suture there arises the *nasal crista*, for the articulation of the vomer. The anterior extremity[6] is the anterior nasal spine. Immediately behind this is the *foramen incisivum* for the naso-palatine nerve and ganglion of Cloquet.

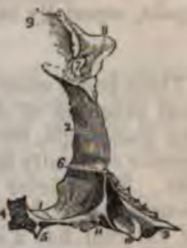
### PALATE BONE.

Situated on each side between the superior maxillary and the sphenoid bone; the figure is irregular and consists of three parts.

The *horizontal* part[1] is quadrilateral in its shape and assists in forming the floor of the nostril and roof of the mouth. The suture between it and its fellow forms a part of the nasal crista for the articulation of the vomer, and posteriorly is elongated into the posterior nasal spine; from which arises the azygos uvulæ muscle.

The ascending or *vertical portion*[2] is divided on its internal or nasal face by a ridge,[6] for the articulation of the inferior turbinated bone; externally it has a rough articular surface for the superior maxillary bone; upon this surface is a groove, converted into the posterior palatine foramen or canal by this articulation, which transmits the palatine nerve and artery. Posteriorly there is an elongated triangular process called *pterygoid*;[3] this process has three grooves, the middle of which forms a part of the pterygoid fossa, and those on each side receive the external[10] and internal[11] plates of the pterygoid process of the sphenoid.

Fig. 15.



The upper extremity of this vertical or nasal portion is formed by two processes separated by a notch which is converted into a

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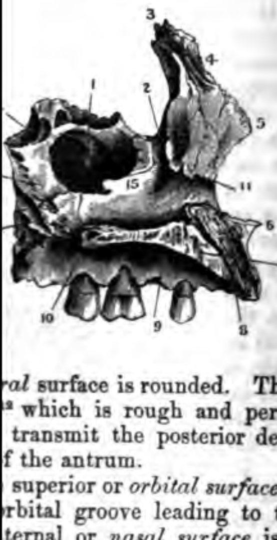


s with its fellow constitutes the upper jaw. It articulates with all the bones of the face with the exception of the lower jaw. It has an irregular cubical body and four processes. The *body* is hollow and has four surfaces.

The anterior or *facial* surface is bounded above by the inferior margin of the orbit, beneath which is the *infra-orbital foramen*, transmitting the infra-orbital nerve, artery and vein. Contiguous to th foramen is a depression, ca the canine fossa, which g origin to the levator an oris muscle. The posteric *ral* surface is rounded. The most prominent part is calle [2] which is rough and perforated by several small for transmit the posterior dental nerve, artery, and vein, f the antrum.

superior or *orbital surface* is triangular, and traversed rbital groove leading to the foramen of that name. ternal or *nasal surface* is the large opening of the *orianum*,[1] which is a pyramidal cavity with thin wa are grooved, indicating the passage of the anterior

terior dental nerves. The opening is diminished by the articulation of the palate, inferior turbinate, and unguiform bones, to a small orifice which opens into the middle meatus of the nose.

The *nasal process*[4] arises from the superior and anterior part of the bone. It is broad and thin below; externally it gives origin to the levator labii superioris alæque nasi muscle, internally it has a transverse ridge dividing the surface unequally for the inferior turbinated bone. The anterior edge articulates with the nasal bone, the superior with the frontal, and the posterior edge has a deep groove, which is converted into a bony canal for the lachrymal sac by the articulation of the os unguis.

The *malar process* is a rough process upon the external and superior part of the bone for articulation with the malar bone.

The *alveolar process* contains the sockets for eight teeth.

The *palate process*[7] is the horizontal roof of the mouth and floor of the nose; uniting behind with the horizontal part of the palate bone,[10] and on the side with its fellow, from which latter junction or suture there arises the *nasal crista*, for the articulation of the vomer. The anterior extremity[6] is the anterior nasal spine. Immediately behind this is the *foramen incisivum* for the naso-palatine nerve and ganglion of Cloquet.

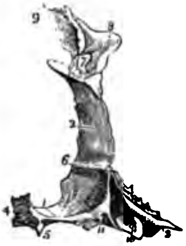
### PALATE BONE.

Situated on each side between the superior maxillary and the sphenoid bone; the figure is irregular and consists of three parts.

The *horizontal* part[1] is quadrilateral in its shape and assists in forming the floor of the nostril and roof of the mouth. The suture between it and its fellow forms a part of the nasal crista for the articulation of the vomer, and posteriorly is elongated into the posterior nasal spine; from which arises the azygos uvulæ muscle.

The ascending or *vertical portion*[2] is divided on its internal or nasal face by a ridge,[6] for the articulation of the inferior turbinated bone; externally it has a rough articular surface for the superior maxillary bone; upon this surface is a groove, converted into the posterior palatine foramen or canal by this articulation, which transmits the palatine nerve and artery. Posteriorly there is an elongated triangular process called *pterygoid*;[3] this process has three grooves, the middle of which forms a part of the pterygoid fossa, and those on each side receive the external[10] and internal[11] plates of the pterygoid process of the sphenoid.

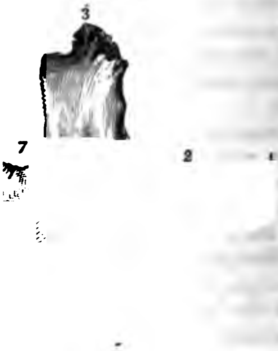
Fig. 15.



The upper extremity of this vertical or nasal portion is formed by two processes separated by a notch which is converted into a

n, called spheno-palatine,[7] by articulation with the sphenoid
and transmits the spheno-palatine artery and nerve. The
r process is called *orbital,*[8] forming a small part of the orbit
n the ethmoid and superior maxillary. The posterior is the *pterygoid apophysis;*[9] it is extremely thin, inclines inwards and fits upon the base of the body of the sphenoid.

Fig. 16.



### MALAR BONE.

Is quadrangular in shape, and forms the prominence of the cheek. It consists of a body and processes. The *body* has three surfaces, the external or facial of which, has numerous small perforations for arteries[7] and nerves; the internal or orbital is smooth and has a notch which limits the spheno-maxillary fissure or foramen lacerum inferius of the orbit;
sterior forms the anterior boundary of the temporal or zygo-
'ossa.

*superior process* is the *frontal,*[3] for articulating with the ex-
angular process of the frontal bone. The *temporal process*[4]
s backwards to unite in forming the zygomatic arch. The
*ıry*[5] [6] is triangular and rough, for articulating with the malar
of the superior maxillary bone. The bone has four edges.
perior[3] is curved and continuous with the orbital ridge, the
r gives origin to the zygomatic and masseter muscles, the
r articulates with the superior maxillary, and the posterior has
ıporal fascia connected with it.

malar bone sometimes contains a cavity called the sin
, especially in Mongolians and Malays.

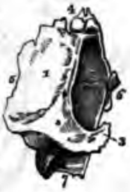
### NASAL BONE.

e bones unite with each other[a] and are placed betwee
processes of the superior maxillary bones. The shap
ıadrangle, but in Africans it is frequently triangular
r extremity is narrow and thick, articulating with the
The inferior is thinner and broader, having the cart
e attached; the internal edge articulates with its fel
ternal has a spiral groove, whereby it is overlappe
rocess of the superior maxillary above, and overlap
low. The anterior surface has numerous foramina
essels; the posterior contains a groove for the inte

### UNGUIFORM BONE.

This is so called from its resemblance to a finger nail (unguis): it is also called lachrymal. It is quadrangular, flat, and small, extremely thin and often cribriform. The external surface[1] forms a portion of the orbit of the eye, and has a groove in front,[2] which completes the canal for the lachrymal sac. From its inferior edge there projects a triangular process[7] which articulates with inferior turbinated bone. The edges[4] [5] [6] articulate with the frontal, ethmoid, and superior maxillary bones.

Fig. 17.



### INFERIOR TURBINATED BONE.

This is a porous scroll, placed at the inferior part of the nasal cavity below the ethmoid. Its posterior end is the more pointed. Its *internal surface* is convex and looks towards the nose; the *external surface* has a broad hook, processus maxillaris,[3] which enters the antrum Highmorianum, and partly closes it. The superior edge has a triangular process called *lachrymal*, which articulates with the unguis. The portions of the edge in front of and behind this process rest upon ridges of the nasal process of the superior maxillary and palate bones; there is frequently a process upon this edge which unites it with the ethmoid bone.

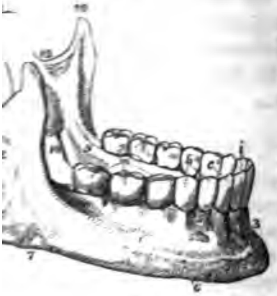
### VOMER.

A single bone, forming a large portion of the nasal septum, consisting of two plates of compact structure. It is a flat bone with four edges. The superior is the thickest, having a deep groove between two lips (alæ) for the reception of the processus azygos of the sphenoid. The inferior edge is the longest, articulating with the nasal crista of the palate suture. The anterior unites with the nasal lamella of the ethmoid, and the posterior is thin, sharp, and concave, separating the posterior openings of the nose.

### INFERIOR MAXILLARY.

Is also single, having a parabolic curve; placed at the inferior portion of the face. It consists of a body and two rami. The body is convex in front and presents in its middle the *anterior mental tubercle* or spine, which in youthful life is a suture. On either side of this is a large hole, called the anterior mental[5] foramen, transmitting a part of the inferior alveolar artery and nerve. The portion of the bone between these two foramina is called the chin. The posterior surface of the chin is concave and has the posterior mental tubercle in its middle, upon which are two marks on each side, for the genio-hyoglossus and genio-hyoid muscles; on either side of ercle or spine is a fossa for the insertion of the digastricus. ing backwards from this tubercle, is a ridge[9] called mylofor the muscle of that name; above this ridge is a shallow or the sublingual gland; below it and behind, is a larger one for the submaxillary gland. The *alveolar process*, contains sockets for sixteen teeth. The inferior edge is the *base*, which is thicker in front, and has two corners giving a squareness to the chin.

Fig. 18.



The ramus[9] is square, and at right angles to the body in manhood; in youth and old age it is oblique; externally it is rough for the masseter muscle, anterior to which is a groove for the facial artery.[7] The internal face has a posterior mental foramen,[13] for the e of the inferior alveolar artery and nerve. To the edge of amen is attached the internal lateral ligament; near it is a [4] transmitting the mylo-hyoidean nerve; below, is the sur- the insertion of the internal pterygoid muscle. The angle[8] h, and has attached to it the stylo-maxillary ligament. The andge of the ramus is continued into the external oblique ridge. superior part of the ramus has two processes separated by noid notch. The *coronoid* process is in front,[10] and is tria nd thin; it has inserted into its apex the temporal muscl t there is a groove for the buccinator muscle. The poste condyle[11] articulating in the glenoid cavity of the tem The neck is narrow, and on the inside of it is a fossa f n of the external pterygoid muscle.

*ures.*—The principal sutures of the head are the *coron* the parietal and frontal bones; the *saggital*, whi parietal bones in the adult, and in a child exter the nose; the *occipital*, which joins the parieta ones; and the *squamous*, uniting the squamous al and the parietal bones. Besides these ther the bones of the face. That part of the sutur l and parietal bones, is called additamentum and that suture between the mastoid and oc nentum suturæ occipitalis.

*tanels.*—These are the deficiencies in ossific of the fœtal head. The *anterior* is large and quadrangular, situated at the junction of the coronal and saggital sutures. The anterior angle is the most elongated. The *posterior* is small and triangular, and situated at the junction of the lambdoidal and sagittal sutures. Besides these there are two smaller fontanels on either side; one is in the angle of the temporal, parietal, and occipital bones, and the other is at the junction of the temporal, parietal, and sphenoid bones.

*Ossa Wormiana* or *Triquetra,* are small bones, irregular in shape and number, sometimes found in the sutures, particularly about the middle of the lambdoidal. They have a distinct point of ossification.

The *diploe* is the cellular bony structure between the external and internal or vitreous tables; it is traversed by channels lined by a venous lining which empty partly into the sinuses of the dura mater and partly into the emissaries of Santorini.

The *cavity of the cranium* is about six and a half inches in length, five in breadth and five in height. When the calvaria or arch of the cranium is removed, three deep fossæ are observed at the base on each side. The anterior is formed by the frontal, sphenoid, and ethmoid bones, and contains the anterior lobes of the brain; the middle is formed by the sphenoid and temporal bones, and lodges the middle lobe; the posterior is formed by the occipital and temporal bones, and contains the cerebellum.

*Orbital cavity.*—Is formed on each side by seven bones.

The cavity is conical, the apex being formed by the optic foramen; the base looks outwards and is somewhat quadrangular. The sphenoidal foramen or fissure opens into the orbit, and is also called *foramen lacerum superius;* another slit or fissure between the sphenoid and maxillary bones being the *foramen lacerum inferius.* Besides these there are other openings into the orbit already mentioned in the description of each bone.

*Nasal Cavity.*—This is an irregular cavity, separated from its fellow by the nasal septum. It has three distinct passages or *meatuses.* The *superior* is between the superior and middle turbinated bones, and has opening into it the posterior ethmoidal cells, the sphenoidal cells, and the spheno-palatine foramen; the middle is between the middle and inferior turbinated bones, and has opening into it the frontal sinus, anterior ethmoidal cells, and the antrum, usually. The inferior is the largest, and between the inferior turbinated bone and the floor of the cavity; into it opens the nasal duct. The opening into the nasal cavity in front is called the *anterior nares;* the opening behind *posterior nares.*

*Zygomatic fossa,* also called temporal, is the large fossa on either side of the head, formed by the parietal, sphenoid, temporal, and frontal bones, and bounded externally by the zygoma. The temporal muscle occupies nearly the whole.

*Pterygo-Maxillary Fossa or Fissure.*—This is at the bottom of the zygomatic fossa, and formed by the sphenoid, palate, and superior maxillary bones. It is triangular, and the base is upwards. The ganglion of Meckel is contained in it, which gives off branches going through the foramina which open upon this fossa. It is continuous with the foramen lacerum inferius or spheno-maxillary slit.

*Facial Angle.*—This is formed by drawing a straight line from the lower part of the frontal bone to the anterior nasal spine, and intersecting it at this latter point by another drawn through the external meatus auditorius. It establishes a relation between the cranium and the face. The smaller the angle the more inferior is the conformation. By comparing the heads of the great races of the world, it is found to be 80° to 85° in Europeans, 75° in the copper-coloured or Mongolians, and 70° in Negroes.

In the African head these additional peculiarities will frequently be found. The temporal fossa is large, and the temporal ridges are nearly approximated.

The pterygoid processes of the sphenoid project in a line parallel with the facial line and thereby alter the shape of the posterior nares.

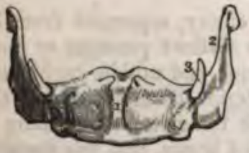
The condyloid processes of the occiput are often divided into two portions by a ridge or groove.

The lower boundary of the anterior nares is deficient in a sharp ridge which characterizes the Caucasian head. In these peculiar features the African adult head seems permanently to retain marks which are generally found to belong to the fœtal head.

## HYOID BONE.

This bone is situated in the neck and connected with the root of the tongue and upper part of the larynx. It is shaped like the Greek *υ*, the convexity being in front. It does not articulate with any other bone. It consists of a body and four cornua. The *body*[1] is quadrilateral, convex in front, and concave behind. The front surface gives origin and insertion to muscles of the neck, and has a well-marked projection. The *greater cornua*[2] are about an inch in length, and in early life united to the body by means of cartilage and ligaments; they are flattened, project backwards, and terminate in a head or tubercle. They give origin and insertion to muscles of the neck. The *lesser cornua*,[3] are attached at the junction of the body and great cornua; they are cartilaginous usually, and of a few lines in length. To them are attached the stylo-hyoid ligaments.

Fig. 19.



## UPPER EXTREMITY.

The upper extremity is divided into the shoulder, arm, forearm, and hand.

The shoulder consists of two bones, the scapula and the clavicle.

*Scapula.*—The shoulder blade of common language. Placed on the back part of the thorax between the second and seventh ribs. It is thin, flat, and triangular; has two surfaces, three edges, and three angles.

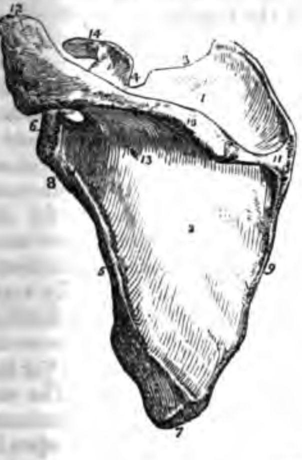
The *anterior face* is a concavity called *costa* or venter, divided by ridges, and giving origin to the subscapular muscle. The posterior face is the *dorsum*, divided by the spine into two fossæ; the fossa supra-spinata,[1] giving origin to the supra-spinatus muscle, and the fossa infra-spinata,[2] giving origin to the infra-spinatus muscle.

The spine[10] is a rough ridge running obliquely across the dorsum, and terminating in the acromion process. The edge of the spine gives origin to the deltoid, and insertion to the trapezius muscles; near the base of the scapula the spine has a small triangular surface,[11] over which plays the trapezius tendon. The acromion process is flat and triangular, has a small articular mark[12] in front for articulation with the clavicle.

*Internal edge or base.*—Is the longest, and nearly parallel[9] with the vertebral column; has an external lip for the insertion of the rhomboid muscles, and an internal one for the serratus anticus.

*External edge.*—Is thick,[5] and contains a *fossa* giving origin to the teres minor muscle. At the upper part of this fossa is a rough mark for the origin[8] of the long head of the triceps.

Fig. 20.



*Superior edge.*—Is thin and small,[3] and has a notch called coracoid,[4] which is converted into a foramen by a ligament, and transmits the supra-scapular artery and nerve. Near this notch arises the omo-hyoid muscle.

*Superior angle.*—Almost a right angle, and has the levator anguli muscle inserted into it.

*Inferior angle.*—Is the most pointed,[7] and gives origin by its posterior surface to the teres major muscle, and is connected with the latissimus dorsi.

*External angle.*—Presents a large articular cavity,[6] called *glenoid*, upon

w neck. This cavity is oval and shallow; and at its summit
rk showing the origin of the long head of the biceps muscle.
*coid process.*—This projects forwards and outwards from the
in a curved manner. Its tip has marks for the insertion of
toralis minor and also for the origin of short head of the
and coraco-brachialis. Its base has a tubercle to which is
l the conoid ligament.

## CLAVICLE.

ng bone placed transversely at the upper and anterior part
thorax, resembling in shape the italic *f*. It articulates
e sternum and scapula. The sternal two-thirds is convex
ly, and the humeral third concave anteriorly. The upper
has a depression near the sternal extremity, showing the
of the sterno-cleido-mastoid muscle. The inferior surface
oughness near the sternal extremity for the rhomboid or
avicular ligament, and near the humeral extremity a tubercle
lge for the coraco-clavicular ligament; the space between
wo marks is for the insertion of the subclavius muscle. The
*r edge* gives origin by its sternal two-thirds to the pectoralis
and by its humeral third to the deltoid. The *posterior* edge
oramen for the nutritious artery.
*sternal extremity* is thick and triangular, with a surface for
tion with the sternum; the posterior and inferior corner of
ngated, which contributes to the strength of the articulation.
*meral* extremity is flat and spongy, with an articular face for
omion process of the scapula.
e male the bone is shorter, thicker, and more curved than
female.

## HUMERUS.

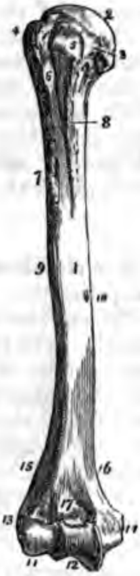
arm-bone is cylindrical, and reaches from the shoulder to the
The superior extremity presents a hemispherical *head*[2] for
tion with the glenoid cavity of the scapula, separated by a
oove, the *anatomical neck*,[3] from the shaft of the bone. Below
oove are two tuberosities; the greater,[4] is the external,
as three facets for the insertion of the supra and infra
s, and teres minor muscles; the lesser, on the inner side,[5] i
insertion of the subscapularis. These tuberosities are sepa
rom each other by a groove,[6] called *bicipital*, in which ,
don of the long head of the biceps muscle. The anteri
*l edge*[7] of this groove has the pectoralis major muscle insert
and the posterior[8] or internal edge, receives the latissimus
ajor muscles. The *surgical neck* is between the insertio
uscles and the anatomical neck of the humerus. About
of the shaft, and upon its outer side, is a triangular rough

for the insertion of the deltoid; on the inner side and a little below is a ridge for the insertion of the coraco-brachialis:[10] below this ridge is the nutritious foramen, and above it is a shallow spiral groove for the musculo-spiral nerve and profunda major artery.

The inferior extremity is flat and broad; anteriorly it is covered by the brachialis anticus muscle, and posteriorly by the triceps. Externally, there is a ridge[15] leading to the *external condyle*,[13] from which arise the supinator and extensor muscles. Internally a ridge[16] leads to the *internal condyle*,[14] which is more prominent than the external, and from which arise the flexor muscles of the forearm and the pronator radii teres.

The articular surface at the elbow consists of a hemispherical head[11] for the radius, and an irregular cylinder[12] for the ulna. Above this articular surface, and in front, is a fossa,[17] called the *lesser sigmoid cavity*, which receives the coronoid process of the ulna in extreme flexion; behind is a larger fossa, the greater sigmoid, for the olecranon in extreme extension. Sometimes these fossæ are connected by an opening.

Fig. 21.



## ULNA.

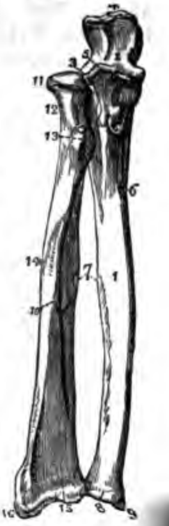
The forearm consists of two bones—Radius and Ulna.

The Ulna is the longer, and is placed on the inner side, reaching from the elbow to the wrist.

The upper extremity is the larger, and has a hook-like process behind,[4] called *olecranon*, to which is inserted the triceps extensor cubiti. In front, is the *coronoid process*,[5] the base of which has a roughness for the insertion of the brachialis anticus muscle. Between the olecranon and coronoid processes, is the greater sigmoid cavity,[2] for articulation with the humerus: continuous with this is the lesser sigmoid cavity,[3] upon the outside of the coronoid process, for the articulation of the head of the radius. Behind the lesser sigmoid cavity, is a triangular, uneven surface, for the insertion of the anconeus muscle. This surface is limited by a ridge giving origin to the supinator radii brevis muscle.

The *body* is prismatic; the anterior surface[1] is occupied in its upper three-fourths by the flexor profundus, and in the lowest fourth, by the pro-

Fig. 22.



uadratus muscle. The posterior surface is occupied by the
›rs of the thumb and the indicator muscle.

external edge[7] is the sharpest, and to it is attached the in-
ous ligament.

lower extremity has a small rounded head,[8] the outer side of
has a smooth articular surface for the radius. From the
ide, there projects[9] the *styloid process*, to which is attached
ernal lateral ligament; behind this process is a groove, in
lides the tendon of the extensor carpi ulnaris muscle.

## RADIUS.

placed on the outer side of the ulna, and is slightly curved
smatic.

*superior extremity* has a rounded *head*,[11] the rim of which is
. The internal part plays in the lesser sigmoid cavity. The
urface of the head has a cup-like depression for articulation
e humerus. Beneath the head is the *neck*,[12] the narrowest
the bone. Below the neck, and on the inner side, is the
,[13] rough below and smooth above, for the insertion of the
muscle.

body is prismatic; *anteriorly*, the surface gradually increases
lth,[10] giving origin to the flexor longus pollicis, and receiving
ertion of the pronator quadratus muscle. The *posterior sur-*
occupied by the extensor major of the thumb and the indi-
uscles. The *external surface* is curved, and has a roughness
he middle for the insertion of the pronator radii teres muscle,
which and below the tubercle is the space occupied by the
n of the supinator radii brevis muscle.

*inferior extremity* is thick and triangular. The surface of
remity[15] is concave and divided by a ridge. It articulates
e scaphoid and lunare. Continuous with this articular sur-
a smaller one on the internal aspect of the extremity for the
tion of the ulna. Externally there is a *styloid process*,[16] for
chment of the external lateral ligament.

a ridge which terminates in the styloid process, is inserted
inator radii longus. Upon the dorsal view of this extremity
one, are three large grooves, each divided into smaller ones.
ove near the supinator ridge transmits the tendons of the
r ossis metacarpi pollicis and the extensor minor pollicis; the
in the middle is the broadest and most shallow, transmitting
dons of the radial extensors; and the groove nearest the ulna
ts the tendons of the extensor communis, indicator, and e
or pollicis. The portion of the groove occupied by the l
deep.

## HAND.

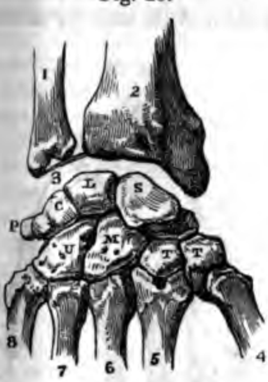
The hand consists of the carpus, metacarpus, and digiti.

The CARPUS or wrist is oblong, the greatest diameter being transverse. The dorsal surface is convex, and the palmar surface is concave, with four prominences. This concavity transmits the flexor tendons.

It consists of *eight* bones arrayed in two rows. The bones of the *superior* row are the *scaphoid*, *lunare*, *cuneiform*, and *pisiform*. Those of the inferior row are the *trapezium*, *trapezoides*, *magnum*, and *unciform*.

*Scaphoid*, is on the radial side, and resembles a boat; has a large convex surface superiorly for the radius, and inferiorly a deep concavity for the magnum. It articulates in front with the trapezium and trapezoides, and on the inside with the lunare.

Fig. 23.



*Lunare*, of a crescentic figure, has a convex surface superiorly for the radius, and a concavity in front for the magnum, articulates on the inside with the cuneiform.

*Cuneiform.*—Wedge-shaped, or pyramidal. Inferiorly it articulates with the unciform. Distinguished by a circular facet on its palmar surface for the pisiform.

*Pisiform.*—Pea-like bone, forms one of the prominences in the palm of the hand, has the flexor carpi ulnaris muscle inserted into it, and has but one articular mark, which is for the cuneiform. It is the smallest bone of the carpus.

*Trapezium*, has the most numerous surfaces and angles. The largest articular surface is for the thumb; two others, joining each other, are for the scaphoid and trapezoides. On the palmar surface is a ridge and a deep groove for the flexor carpi radialis tendon.

*Trapezoides*, is the smallest bone of this row. It is a four-sided pyramid with its apex towards the palm; its dorsal surface is the base and inclines inwards.

*Magnum.*—The largest bone of the wrist. Has a rounded head looking backwards; the body is quadrilateral.

*Unciform.*—Distinguished by a hook-like process, resembling a nail, on its palmar surface, which gives origin to the flexor brevis minimi digiti.

## METACARPUS.

ists of five bones, each having a head, shaft, and base.

*head* is rounded, articulating with the first phalanx; a rough- each side indicates the attachment of the lateral ligament.

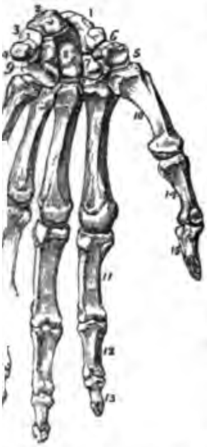
*base* is the superior extremity, rough, and quadrilateral, articular marks on the extremity and either side.

*body* or *shaft* is prismoid, having impressions on its sides for erossei muscles.

*first* is short and thick, and belongs to the thumb. Its base t one articular surface, and that is for the trapezium. Its not very spherical, and its palmar surface articulates with amoid bones.

*second* is the longest, and belongs to the index finger; it has at its base for articulating with the trapezoid; and a lateral articular mark upon one side only: a mark upon its dorsal surface indicates the insertion of the extensor carpi radialis longior.

Fig. 24.



The *third* has a *triangular* base with an articular mark on each side, and on its dorsum one for the extensor carpi radialis brevior.

The *fourth* is much smaller. The external lateral surface of its base is double.

The *fifth* is the smallest. Its base has but one lateral surface, and that is external and single. Internally there is a tubercle at the base for the extensor carpi ulnaris.

## FINGERS.

The fingers contain three bones called *phalanges:* the thumb has but two.

*t row.*—The *phalanges* of this row are the largest, convex on orsal, and flat on the palmar surface. The superior extremity ingle concavity for the head of the metacarpal bone. The extremity has two convexities separated by a groove. A ess on either side of this extremity, indicates the attachment lateral ligament. The ridges extending from one extren other are for the theca of the flexor tendons.

*nd row.*—These are smaller. The superior extremity cavities, separated by a ridge; the inferior two convexi ed by a groove. The ridge on either side of the body ca and tendon of the flexor sublimis attached to it.

*d row.*—These are the smallest, and differ much from t other rows, having but one articular extremity, which is the superior, having two concavities and a ridge. The inferior extremity is flattened, thin, and rough.

The middle finger (*impudicus*) is the longest. The ring finger (*annularis*) is the next in size. The forefinger (*indicator*) is thicker than the last. The little finger (*auricularis*) is the smallest.

*Sesamoid bones.*—These are four in number—two being placed upon the palmar side of the lower extremity of the metacarpal bone of each thumb, in connexion with the short flexor tendon.

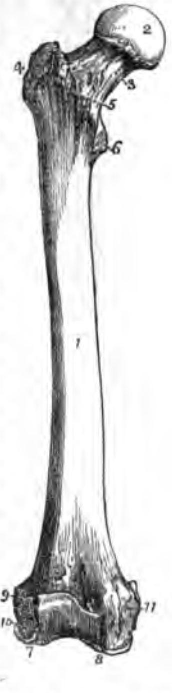
## LOWER EXTREMITY.

### FEMUR.

The *femur* is the longest bone in the body, reaching from the acetabulum to the knee.

The superior extremity presents a spherical *head*,[2] which has a depression upon it for the ligamentum teres. The part between the head and shaft is the *neck*,[3] which is shorter and more horizontal in old persons and in females. Externally is the *trochanter major*, a large process having an oval mark in front for the gluteus minimus; and above a double mark for the gluteus medius; the tip has the pyriformis inserted into it, and behind the tip is the *digital fossa*, into which are inserted the gemelli and obturator muscles. Below and on the inner side is the *lesser trochanter*, into which is inserted the psoas magnus, and iliacus internus muscles. A ridge between the trochanters behind, indicates the insertion of the quadratus femoris, and a corresponding one in front[5], which is less distinct, serves for the connexion of the capsular ligament.

Fig. 25.

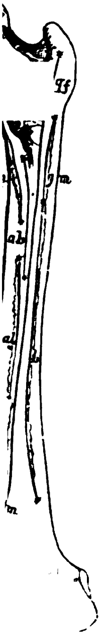


The *inferior extremity* is broader than the upper, and is divided by a fossa in front, and a notch behind, into two *condyles*. The *internal* condyle seems to be much the longer,[6] and is in reality somewhat so; its internal surface[11] gives origin to the internal lateral ligament and its posterior to the gastrocnemius muscle; its external surface assists in forming the notch, and has a roughness in front for the posterior crucial ligament.

The *external condyle* contributes by its internal surface to form the notch, and has a roughness behind for the anterior crucial ligament. Its posterior surface gives origin to the popliteus, plantaris, and gastrocnemius muscles, and its external to the external lateral ligament. The *fossa* in front, is unequally between the condyles, the larger and flatter portion belong- he external. In this fossa plays the patella.

shaft of the bone is curved *anteriorly,* and is covered in the origin of cruræus muscle. Posteriorly there is a rough alled *linea aspera* (Fig. 26), which consists of two lips a tendency to separate above and below. The inner lip the insertion of the pectineus muscle,[p] of the adductor [b] and of the adductor magnus.[am] This last insertion occupies this inner lip in nearly its whole length; so also does the origin of the vastus internus. The outer lip has inserted into it the gluteus maximus,[gm] and also gives origin to the vastus externus, and the short head of the biceps flexor cruris.[b]

g. 26.



## PATELLA.

The patella is the largest sesamoid bone in the body, and commonly called the knee-pan. It is flat and triangular; thick and broad above, and thin and pointed below. The *anterior surface* is covered by integument; the *posterior* is a smooth articular surface divided by a ridge unequally—the external portion is the larger and flatter, adapted to a corresponding surface of the femur. The *superior edge* is thick, and has the tendon of the rectus inserted into it. The inferior is pointed, and to it is attached the ligament of the patella.

## TIBIA.

The tibia is longer and thicker than the fibula. It is placed on the inside of the leg, and commonly called the shin-bone. The superior extremity, or *head,* is large and thick, presenting an oval articular surface for the femur. This surface is divided by a pyramidal eminence, the *spinous process,*[4] into two surfaces, both of which l, but the internal is longer and deeper; to the base of this process are attached anteriorly and posteriorly the *crucial its;* in a depression upon its summit is fastened the poster the external semilunar cartilage. (Fig. 27.)

nlargement upon either side of the head are called tubero condyles; upon the posterior part of the *external condyle*[1] articular face, looking downwards, for the head of the fibu ie posterior part of the *internal condyle*[2] is a depression rtion of the semi-membranosus tendon.

Below the head, and in front, is a prominent *tubercle*[5] for the insertion of the ligament of the patella, and above it a smoothness corresponding with its bursa; below the head, and behind, is a triangular surface,[4] occupied by the poplitæus muscle, limited by an oblique ridge[5] (Fig. 28), which gives origin to the soleus muscle.

The *body* is prismatic. Its internal surface[6] (Fig. 27) is smooth and covered by the skin; the external surface gives origin to the tibialis anticus and extensor communis digitorum; from the posterior surface arise the tibialis posticus and flexor communis digitorum.

The *anterior* edge[1] (Fig. 27) is sharp and superficial, generally curved with some resemblance to the italic *f*; the *external* has a ridge for the attachment of the interosseous ligament, and the *internal* is rounded, having the sartorius, gracilis, and semi-tendinosus inserted into it at its upper part.

Fig. 27.

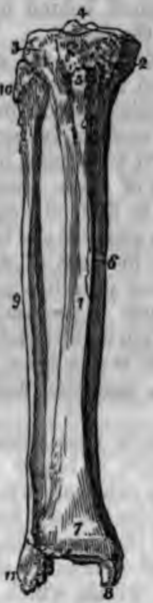
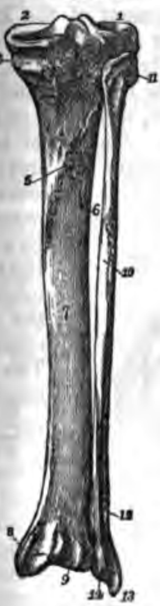


Fig. 28.



The inferior extremity is smaller than the superior, and four-sided. Over the *anterior* surface pass the extensor tendons; on the *posterior* is a slight fossa[9] (Fig. 28) for the tendon of the flexor longus pollicis; *externally* there is a rough triangular fossa for the articulation of the fibula; and *internally* there is a large process, called the *internal malleolus*[8] (Fig. 28), behind which is an oblique ransmitting the tendons of the tibialis posticus and flexor digitorum pedis. The inferior extremity of the malleolus ıed for the attachment of the internal lateral ligament; its l surface is superficial; its external surface is continuous ıe quadrangular concavity at the extremity of the bone, for iculation of the astragalus.

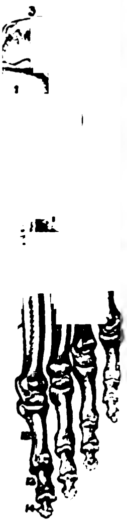
## FIBULA.

fibula is a long thin bone placed upon the outside of the leg, mewhat posteriorly at the upper part (Fig. 27 ⁹, Fig. 28 ¹⁰). ightly twisted in its appearance, and has a convexity back-The superior extremity or head is thick and large, and ıtes with the external condyle of the tibia. External to this ır surface, is a mark for the attachment of the external ligament of the knee-joint, terminated behind by a styloid , for the insertion of the tendon of the biceps.

body is prismatic, and has three surfaces; the external of ıs the broadest, and commencing upon the anterior part of the bove, winds around it, so as to terminate upon its posterior low. The upper two-thirds of this surface give origin to the ıs longus and brevis; the lower third terminates in a groove, indicates the course of the tendons of these muscles. The l face looks towards the tibia, and is divided longitudinally by a ridge, to which is attached the interosseous ligament; the space in front of which gives origin to the extensor proprius pollicis, and the extensor communis digitorum; and the space behind gives origin to the tibialis posticus. The posterior surface is also spiral, and gives origin to the soleus, and the flexor longus pollicis muscles.

The inferior extremity terminates in the *external malleolus*, which is longer and flatter than the internal. Its external surface is superficial and triangular; its internal has a smooth articular surface for the astragalus. The extremity is pointed, and often called the coronoid process, immediately within which is a rough depression for the external lateral ligament.

Fig. 29.



## FOOT.

It consists of the tarsus, metatarsus, phalanges. The TARSUS consists of seven bo viz.: os calcis, astragalus, cuboid, scapl and three cuneiform.

*Os Calcis.*—This is the largest of the ta and constitutes the *heel.* Its figure is longitudinal. *S*ı *riorly* it has two articular surfaces for the astragalus, separated by a deep groove, in which is fastened the interosseous ligament. The posterior portion is convex and the larger of the two. The anterior is narrow, concave, and divided by a small groove into two parts.

The *internal* surface has a deep concavity, called the sinuosity, for the passage of tendons, vessels, and nerves of the sole of the foot. The *external* surface is covered by the skin, and has two grooves for the tendons of the peroneus longus and brevis. The *inferior* surface has two tuberosities behind, of which the internal is the broader and larger; and also one in front. These tuberosities give origin to muscles and ligaments. The *posterior* extremity[3] is rough and prominent in its inferior half, into which is inserted the tendo-achillis; the superior half is smooth, corresponding with the bursa. The *anterior* extremity presents two processes, called the greater and lesser apophyses; the *greäter* is external and below, and has a flat triangular articular surface for the cuboid bone, surmounted by a rough projection. The *lesser apophysis* (sustentaculum tali) is a blunt hook projecting forwards and upwards, having an articular concavity above, constituting that portion of the superior surface of the bone, which articulates with the astragalus; upon its inferior surface is a groove for the tendon of the flexor longus pollicis.

*Astragalus.*[1]—Is next in size to the os calcis. It consists of a body and a head. *Superiorly* the *body* presents a large articular convexity for the tibia; continuous with this, on either side, is an articular surface for the malleoli; that upon the external side is the larger; *inferiorly* is a concavity, divided by a deep rough groove for the interosseous ligament; *posteriorly*, is a slight groove for the flexor longus pollicis.

The *head*[2] is upon the anterior portion of the bone. It presents a large anterior convexity, the horizontal diameter of which is the greatest. On the internal side of the head is a small triangular surface, which rests upon the calcaneo-scaphoid ligament. The head is united to the body by a narrow portion called the neck, which has a depression superiorly and inferiorly.

*Scaphoid.*[4]—Is oval, thicker above than it is below; *posteriorly* it has a deep concavity for the head of the astragalus; *anteriorly*, an articular convexity, divided by ridges into three triangular facets for the cuneiform bones. *Internally*, is a tubercle for the insertion of the tibialis posticus tendon; and *externally*, there is sometimes a small articular face for the cuboid.

*Cuboid.*[5]—Placed at the outer portion of the foot, is somewhat cuboidal in shape; *superiorly*, it is rough and convex; *inferiorly*, is a prominent ridge for the calcaneo-cuboid ligament, and in front of this ridge is a groove, commencing at the external edge, and running obliquely forward, in which plays the tendon of the peroneus

; *internally*, it articulates with the external cuneiform; *an-*
with the fourth and fifth metatarsal bones; *posteriorly*, is
spiral surface for the greater apophysis of the os calcis.

*nal Cuneiform.*[5]—Is the largest of the three cuneiform bones.
edge-shaped, and is placed upon the inner side of the foot.
all extremity of the wedge looks upwards. Its internal sur-
convex, and immediately beneath the skin; its external sur-
concave, and has articular marks for the second cuneiform
second metatarsal bones; *anteriorly*, is the largest arti-
rface, for the metatarsal bone of the big toe; *posteriorly*, is
gular articular cavity for the astragalus, with the base down-
The *inferior* surface of the bone, or the base of the wedge,
led into a tuberosity; upon the inner side, is inserted the
of the tibialis anticus.

*lle Cuneiform.*[6]—Is the *smallest* of the three, and placed with
of the wedge upwards; *anteriorly*, it articulates with the
metatarsal bone; *posteriorly*, it is slightly concave, and arti-
with the scaphoid; *internally*, it articulates with the internal
rm, and *externally*, with the external cuneiform bone.

*rnal Cuneiform.*[7]—Intermediate in size between the two
It is wedge-shaped and base upwards. *Anteriorly* it articu-
th the third metatarsal bone; *posteriorly* there is a quadran-
acet for the scaphoid; *internally* it has two articular sur-
he posterior of which is the larger, and for the internal cunei-
one; the anterior is for the second metatarsal. *Externally*
gular projection, in front of which is a small facet for the
metatarsal bone, and behind which is an articular surface for
oid bone.

## METATARSUS.

ists of five parallel long bones,[9] whose heads are rounded
ticulate with the toes, and whose bases articulate with each
three cuneiform and cuboid bones. There is a roughness on
de of the head to which is attached the lateral ligament.
cks are narrow.

. Is on the inside of the foot, and is easily recognised, being
rtest and thickest of the set. Its base is large and articulates
e internal cuneiform bone, and has a tubercle below for the
n of the peroneus longus. The head is spherical, articulating
e first phalanx in front, and below with the sesamoid bo
*nd.* Is the longest. Its base articulates with the m
rm, on the inside with the internal cuneiform, and or
with the third metatarsal and external cuneiform.
*d.* Is distinguished by the external surface of its base ha
icular facets for the fourth metatarsal. The base articu
e external cuneiform.

*Fourth.* Its base articulates with the cuboid, and on either side with the contiguous metatarsal bone. The internal lateral face of the bone is distinguished by having two articular marks.

*Fifth.* Is the smallest and readily recognised by the large tubercle projecting backwards and outwards from the base, into the superior part of which is inserted the peroneus tertius, and into the extremity the peroneus brevis. This process is a surgical guide in Hey's amputation of the foot. The base articulates with the cuboid and fourth metatarsal.

### TOES.

There are five on each foot. Each consists of three *phalanges*, with the exception of the first or great toe, which, like the thumb, has but two.[10] [11]

The *first row*[12] of phalanges are smaller than those of the fingers, and readily distinguished by the narrowness of their bodies. The bases have a single concavity; the anterior extremities have two convexities, separated by a groove.

The *second row.*[13]—These phalanges have hardly any body; the posterior extremities have two concavities separated by a ridge; and the anterior, two convexities separated by a groove.

The *third row.*[14]—These phalanges are very small; their bases have two concavities and a ridge. The anterior extremity is flat and rough.

*Sesamoid Bones.*—These are four small sections of a sphere of bone; two being imbedded in the tendon of the flexor brevis pollicis of each foot. The flat surfaces play on the inferior part of the head of the metatarsal bone of the great toe.

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## SECTION II.

## ARTICULATIONS.

### LIGAMENTS.

An articulation or joint is the connexion of one bone with another. Where much motion is required, it is necessary that *cartilage, ligaments, and synovial* membranes should be employed in the mechanism.

*Cartilage.*—Is white, flexible, elastic, and hard. Its chemical composition is, gelatine 44·5; water 55; phosphate of lime 0·5. By boiling it becomes yellow, swells, and the gelatine is dissolved. It resists mortification and putrefaction longer than any tissue except bone. When dried it becomes hard and contracted, and semi-transparent, resembling common glue. Soaking in water restores its appearance. It contains no red blood-vessels, nor can nerves

hatics be traced in it. Microscopically examined it ex-
val cells. Old age disposes it to ossify, particularly in the
l larynx.

*hondrium* is the fibrous investing membrane of cartilage,
onding to the periosteum of bone.

*ular cartilages.*—These cover the extremities of bone and
or equalize pressure. Those lining the cavity are thicker
edges; those covering a convexity are thicker in the middle.

*ticular* cartilages are free and moveable in the joint, not
g a bony surface, and held in their places by connexion with
its: they are called menisci, from their shape.

*o-cartilage.*—Is stronger and tougher than cartilage; it is
ed partly of ligament and partly of cartilage; it is found in
at the symphysis pubis, and between the vertebræ.

*ments* consist of *fibrous* tissue, of which there are two kinds,
which is inelastic, and *yellow*, which is elastic; the white is
tendons, fasciæ, and in most of the ligaments; the yellow is
the ligamentum nuchæ, and in many vessels and ducts.

ments are called *capsular* when they are bag-like, as at the
r and hip; *funicular*, when cord-like, and *membranous* when
iband.

*vial membranes* are thin, transparent, closed serous sacs,
apsular ligaments, and secreting an albuminous fluid called
, which resembles in appearance the white of an egg. It
tes the joints, and prevents attrition. Masses of fat outside
synovial membranes are usually called *glands of Havers.*
o not secrete, however, but serve a mechanical purpose in
p spaces which would otherwise be formed in many articula-
uring the performance of certain movements. The synovial
are nothing but folds of the synovial membrane, including
ortions of fat.

principal kinds of articulations are termed:

ARTHROSIS, implying immobility, and including

*Sutura.*—Bones of the skull.
*Harmonia.*—Superior maxillary bones.
*Schindylesis.*—Vomer with processus azygos.
*Gomphosis.*—Teeth with alveoli.

HIARTHROSIS implies partial motion, and is exemplified in
nphyses, and in the bodies of vertebræ.

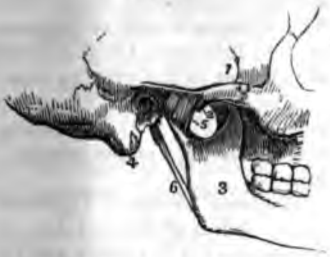
RTHROSIS is a moveable articulation, and includes

*Arthrodia.*—Such connexions as exist between the tarsal and carpal bones.
*Ginglymus.*—Hinge-like joints, such as the elbow
ankle.
*Enarthrodia.*—Ball-and-socket joints, such as the hip
shoulder.

## ARTICULATION OF THE LOWER JAW.

*Capsular Ligament.*—Extends from the border of the glenoid cavity of the temporal bone, and surrounds the neck of the condyloid process of the lower jaw.

Fig. 30.



*External Lateral Ligament.*[5] —Is broad and triangular, covering the outside of the joint, extending from the tubercle at the root of the zygoma to the outside of the neck of the condyle. (Fig. 30.)

*Internal Lateral Ligament.*—Properly speaking, not a ligament but a fibrous band or sheath for the protection of vessels and nerves from the contraction of the pterygoid muscles. It passes from the spinous process of the sphenoid to the spine at the margin of the posterior mental foramen.[4] (Fig. 31.)

*Stylo-Maxillary,*[6] (Fig. 31,) is an extremely thin fibrous band, extending from the styloid process of the temporal bone to the angle of the lower jaw.

Fig. 31.

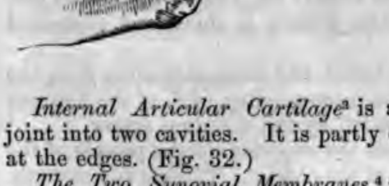
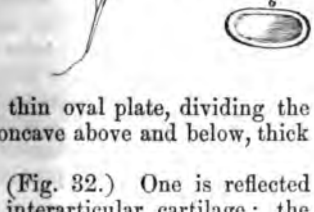


Fig. 32.



*Internal Articular Cartilage*[3] is a thin oval plate, dividing the joint into two cavities. It is partly concave above and below, thick at the edges. (Fig. 32.)

*The Two Synovial Membranes.*[4] [5] (Fig. 32.) One is reflected between the glenoid cavity and the interarticular cartilage; the other between the cartilage and the condyle of the jaw. When the cartilage is perforate, the two cavities are lined by one synovial membrane.

## LIGAMENTS OF THE VERTEBRÆ.

### BODIES.

*vertebral Substance.*—The bodies of the vertebræ are united o-cartilaginous disks, which are twenty-three in number, con- of concentric rings; toward the centre there is a yellow jelly- ss, in a state of compression; it is whiter and more abun- infancy. On this account persons are stiffer in old age, and rter in the evening than they are in the morning.

*rior Vertebral Ligament*[1] is in front of the bodies of the æ (Fig. 35[1]); extending from the second vertebræ of the the first of the sacrum; it is thin and gradually increases in l.

*rior Vertebral Ligament.*—It lies upon the posterior surface bodies of the vertebræ, and extends from the occiput to the ygis; it is narrow and thick in the thorax, adheres closely to tervertebral substance, and its edges present a serrated nce.

CESSES.—*Oblique.*—These are surrounded by capsular liga- lined by a synovial membrane.

*ous.*—The spaces between the processes are filled by the *inal ligaments.* In the back they are triangular, in the uadrangular, and in the neck deficient. The free edge of the nt is thick and cord-like.

*mentum Nuchæ.*—Continuation of the last, reaching from enth cervical vertebra to the vertical ridge on the occiput.

*no Ligaments* are between the bony bridges of the vertebræ ty-three pairs; the first is between the second and third æ. They are remarkable for their elasticity and colour.

### ATLAS AND OCCIPUT.

*rior Ligament,* is a strong, broad ligament, extending from erior edge of the anterior arch of the atlas to the basilar pro- the occiput. The middle portion is thick, and connected e tubercle of the atlas.

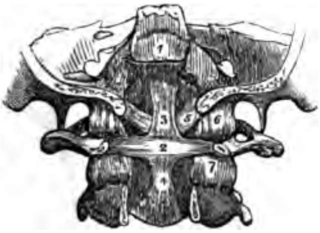
*rior Ligament,* is thin, broad, and loose, extending from the r arch of the atlas to the corresponding edge of the foramen m occipitis. It is perforated by the vertebral artery.

*sular Ligament,* surrounds the superior oblique process of the d the condyloid process of the occiput. Thicker and strong t.

### ATLAS AND DENTATA.

*sverse Ligament,* stretches across the atlas from one tuber to the other, dividing it into two rings[2] (Fig. 33), and has an appendix above,[3] connecting it with the occiput, and one below,[4] connecting it with the dentata.

Fig. 33.



*Moderator Ligaments* are short and thick; extending from the sides of the apex of the processus dentatus[5] to a process on the inner side of each condyle. They limit rotation of the head.

*Middle* or *Straight Ligament*, reaches from the tip of the processus dentatus to the anterior edge of the foramen magnum.

*Capsular Ligament* of the oblique process of the atlas and dentata is very loose.

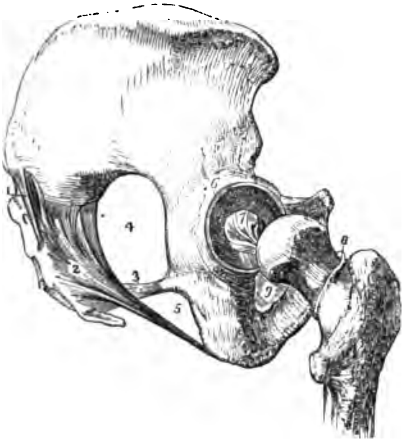
*Lacerti Ligamentosi* are ligamentous bands extending from the occiput to the posterior part of the body of the dentata.

### LIGAMENTS OF THE PELVIS.

*Sacro-Iliac Symphysis.*—The articular surfaces are covered by cartilage and united by short, thick, strong fibres, which are with difficulty divided. A yellow fluid is sometimes interposed, and in children and pregnant women a synovial membrane.

*Sacro-Iliac Ligament;* short ligamentous fibres passing from bone to bone surrounding the joint, and thicker behind.

Fig. 34.



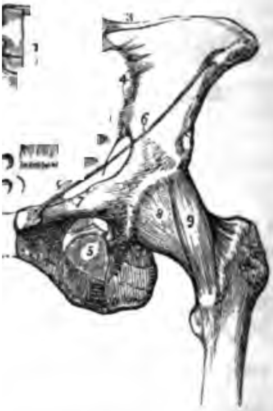
*Sacro - Spinous Ligament;* consists of two laminæ, composed of numerous strong fibres, passing from the posterior inferior spinous process to the transverse processes of the third and fourth sacral vertebræ.

*Greater Sacro-Sciatic Ligament,*[2] extends from the posterior inferior spinous process of the ilium, margin of the sacrum and of the first bone of the coccyx, to the inner margin of the tuberosity and ramus of the ischium.

*Lesser Sacro-Sciatic Ligament;* in front of last; arises from the

the sacrum[3] (Fig. 34), and coccyx; inserted into the spine ischium.

Fig. 35.



These two ligaments form the posterior and lateral boundaries of the pelvis, converting the sacro-sciatic notch into two foramina[4 5] (Fig. 34).

*Ilio-Lumbar Ligament,* passes from the transverse process of the last lumbar vertebra to the posterior part of the crest of the ilium.[3] (Fig. 35.)

*Lumbo - Sacral Ligament,* arises from the transverse process of last lumbar vertebra, and is inserted into the upper part of the sacrum.[2] (Fig. 35.)

*Anterior Coccygeal Ligament.*—Its fibres are indistinct, often wanting—runs in front of the whole length of coccyx from the last bone of the sacrum.

*erior Coccygeal Ligament,* arises from the inferior margin of ral canal, and terminates at the second bone of the coccyx.

*rator Ligament*[5] (Fig. 35).—Fills up the thyroid foramen; branous and thin, perforated at its upper part for the trans- of the obturator vessels.

*Pubic Ligament.*—A thick, triangular ligament, rounding x of the arch of the pubis; reaching from one bone to the

*physis Pubis.*—The bones are connected by fibro-cartilage, ling intervertebral substance; sometimes there is a synovial ane. A few transverse fibres in front and behind are called r and posterior ligaments.

## THORAX.

### VERTEBRÆ WITH THE RIBS.

*rior or Radiated Ligament.*—Short fibres radiating from d of the rib, to the two contiguous vertebræ and the sub- between them.

*sular Ligament.*—Surrounds the head of the rib; thicl nd below.

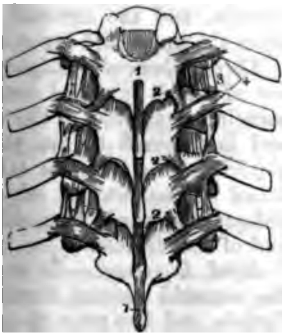
*-articular Ligament.*—A thin band passing from the r head of a rib to the intervertebral substance, dividing into two parts, each of which has a distinct synovial membr st, eleventh, and twelfth are exceptions to this rule.

The tubercle of the rib is connected to the transverse processes by a *capsular* ligament, and also the *internal costo-transverse ligament*[3] passes from the inferior edge of the transverse process, and is inserted in the sharp edge of the neck of the rib below.

*External costo-transverse Ligament.*[4]—Is quadrangular, extending between the transverse process and the contiguous rib.

*Middle costo-transverse Ligament.*—A collection of short irregular fibres mixed with reddish adipose tissue, passing directly from the transverse process to the rib.

Fig. 36.



RIB WITH STERNUM.

Anterior extremity of ribs.

*Anterior radiated Ligament*[6] (Fig. 37).—Consists of a number of fibres, reaching from the cartilage of the true ribs to the sternum, and blending themselves with the periosteum.

*Posterior radiated Ligament.*—Not so distinct as the last, passing in the same direction upon the under surface.

*Costo-xiphoid Ligament.*—Reaches from the cartilages of the sixth and seventh ribs, to the ensiform cartilage.

A synovial membrane and ligamentous fibres are found between the sixth and seventh, and eighth and ninth, sometimes.

UPPER EXTREMITY.

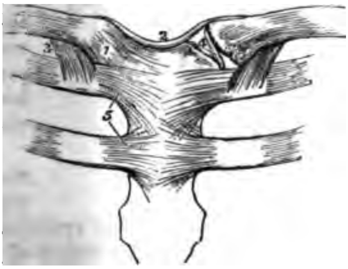
SHOULDER.

The clavicle and sternum have interposed a wedge-shaped *inter-articular cartilage,* dividing the joint into cavities, and the whole is surrounded by a strong *capsular ligament*[1] (Fig. 37), which is fibrous and thick, looser before than it is behind.

*Inter-clavicular Ligament.*[2]—A ligamentous cord stretching from the end of one clavicle to the other.

*Rhomboid Ligament.*[3]—A strong, thick ligament, proceeding from the upper surface of the cartilage of the first rib obliquely upwards and outwards to the inferior and sternal end of the clavicle.

Fig. 37.



## CLAVICLE AND SCAPULA.

ular *Ligament.*[1]—Surrounds the acromion process of the , and the external extremity of the clavicle. The fibres ne upper and lower surface are very distinct and strong.

*co-clavicular Ligament*[2] (Fig. 38).—Consists of two parts, which is called *conoid;* it is triangular and vertical; com- g at the root of the coracoid process, it expands as it ascends, fastened to the tubercle at the inferior extremity of the e. The other is called *trapezoid;* it is in front of the last, at the internal edge of the coracoid process, and proceeds ly upwards to a ridge on the lower surface of the external the clavicle.

*l Ligament.*—Is an aponeurotic expansion, commencing at acoid process, terminating upon the inferior surface of the , and also upon the cartilage of the first rib. It protects the portion of the subclavius muscle.

*co-acromial Ligament*[3] (Fig. 38).—Is thick and triangular; se commences upon the outer edge of the coracoid process, e apex is fastened to the acromion; it prevents a dislocation humerus upwards.

*coid Ligament*[4] (Fig. 38).—Is a small transverse fasciculus, ed across the coracoid notch, and converting it into a foramen supra-scapular artery and nerve.

## HUMERUS AND SCAPULA.

Fig. 38.

*Capsular Ligament*[5] (Fig. 36).—Surrounds the glenoid cavity and the neck of the humerus; it is loose and perforated by the tendon of the long head of the biceps.[7] It is deficient behind; this deficiency is supplied by the tendons of the surrounding muscles, particularly the sub-scapularis.

*Coraco-humeral Ligament.*[6]—Is sometimes called adscititium; is a thick fasciculus of the capsular ligament, proceeding from the coracoid process. It holds the head of the bone on a level with the glenoid cavity.

*Glenoid Ligament.*—A prism ring of fibro-cartilage, attached to edge of the glenoid cavity, and ; its depth. The synovial membrane is very extensive, nicates with the bursæ of tendons.

## ELBOW JOINT.

*Capsular Ligament.*—It surrounds the extremities of the humerus, radius, and ulna. It is strengthened by the

*Internal lateral Ligament*[2] (Fig. 39), which, commencing at the internal condyle, has two insertions, one into the coronoid, and the other into the olecranon process of the ulna.

*External lateral Ligament*[4] (Fig. 40).—Is triangular, commencing at the external condyle, and terminating in the annular ligament.

*Coronary or annular Ligament*[5] (Fig. 41).—Is strong and dense, surrounding three-fourths of the head of the radius; its extremities are fastened on either side of the lesser sigmoid cavity.

*Interosseous Ligament*[5] (Fig. 39).—Is a ligamentous membrane, filling up the space between the radius and ulna throughout their length. It is perforated at its upper part, for the transmission of the posterior interosseal artery; this deficiency is compensated for by the *ligamentum teres*[4] (Fig. 39), whose fibres are oblique and in an opposite direction to those of the interosseous ligament. It commences at the coronoid process, and terminates below the tubercle of the radius.

Fig. 39.

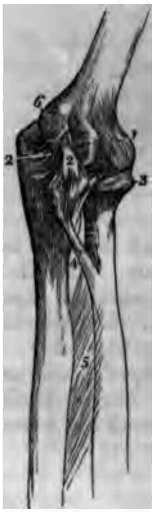


Fig. 40.

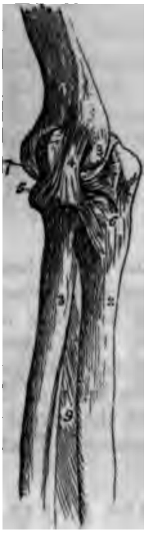
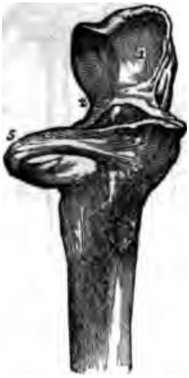


Fig. 41.



*Sacciform Ligament.*—Is a loose capsular ligament, surrounding the lower extremity of the ulna, and attached to the lesser sigmoid

f the radius. This is strengthened by the *anterior radio-*
*igament*[2] (Fig. 42), which passes obliquely between the two
nd the *posterior radio-ulnar ligament.*

### WRIST JOINT.

joint is formed by the greater sigmoid cavity of the radius
scaphoid, semilunar, and cuneiform bones. It is surrounded
capsular ligament, which is strengthened by an *anterior*
*t*[3] (Fig. 42), a broad membranous layer; *an internal lateral*
*t*,[5] reaching from the styloid process of the ulna to the
rm and pisiform bone; an *external lateral ligament*,[4] reach-
m the styloid process of the radius to the scaphoid bone;
*osterior ligament*, which is thin and loose, passing between
terior surface of the radius, semilunar, and cuneiform bones.

Fig. 42.

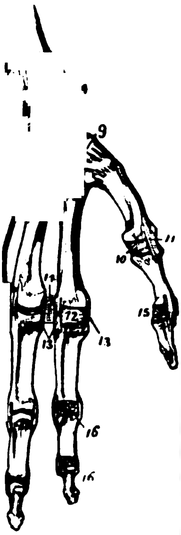
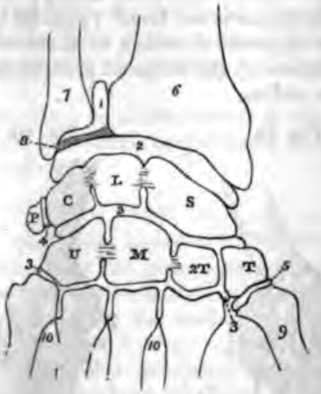


Fig. 43.



The *carpal* bones are held together by *dorsal* and *palmar* ligaments. The *pisiform bone* has a distinct *capsular ligament.* The arrangement of the synovial membrane is represented by Fig. 43.

The bases of the *metacarpal bones* are
to the second row of the carpal bones by fibrous bands
*orsal* and *palmar* ligaments. That of the thumb has a true
*r ligament.*

### FINGER JOINTS.

joint between the metacarpal bones and the first row of pl
is a ball-and-socket joint. It is secured by an *internal*
*l* lateral ligament[13] (Fig. 42), which are very thick in

portion to the size of the bone; the *anterior or palmar ligament*[13] is in front, and has the flexor tendons playing over it; the extensor tendon taking the place of a *posterior ligament.* The heads of the metacarpal bones are also connected by transverse ligaments.[14]

The second and third joints of the finger[15] are arranged upon the same principle as the first, with the exception of the transverse ligament.

## LOWER EXTREMITY.

### HIP JOINT.

*Capsular Ligament*[8] (Fig. 35).—Is the largest and strongest capsule in the body, and surrounds the acetabulum and the neck of the femur. It is thicker and longer in front than it is behind, and is strengthened by a bundle of fibres,[9] called *ilio-femoral.*

*Cotyloid Ligament*[6] (Fig. 34).—Is a thick prismatic ring of fibro-cartilage, surrounding and deepening the acetabulum.

*Ligamentum teres*[7] (Fig. 34).—Is attached to a pit upon the head of the femur, and divides into two fasciculi, which are inserted into the corners of the notch of the acetabulum and the cotyloid ligament. The synovial membrane is extensive, and the Haversian mass is large.

### KNEE JOINT.

This joint is surrounded by an expansion of the fascia lata of the thigh, called the *involucrum generale.*

*Anterior Ligament.*—Is the *ligament of the patella*[2] (Fig. 44); it is the strongest ligament of the body. It is a continuation of the tendon of the quadriceps muscle,[1] in which the patella[2] is enclosed, previous to its insertion into the tubercle of the tibia.

*Posterior Ligament.*—Is the *ligament of Winslow*[1] (Fig. 45). It is a broad ligament passing obliquely from the external condyle of the femur to the posterior part of the internal tuberosity of the tibia. Its strongest fasciculi are derived from the semi-membranosus tendon.[2] It has numerous openings for blood-vessels.

Fig. 44.

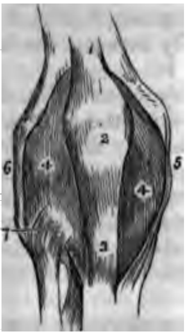
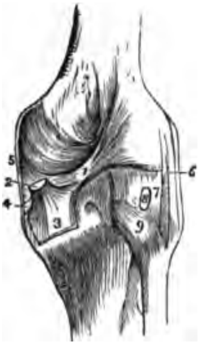


Fig. 45.



*Internal Lateral Ligament.*—Is broad, thin, and membranous,

ng from the internal condyle of the femur to the lower part
nternal tuberosity of the tibia.[5].

*rnal lateral Ligament.*—Is a strong cord-like ligament[6] reach-
m the external condyle to the superior extremity of the
Posterior to this, and parallel with it, is another shorter
ıt also connecting the femur and fibula.

*ilunar Cartilages.*—Are two prismatic rings of fibro-carti-
epening the articular surfaces of the tibia. The external[7]
6) is the smaller and more circular. The internal[8] is the
and a semicircle. The extremities are attached to the spi-
ocess of the tibia. A small transverse ligament[4] connects
hind.

*ial Ligaments.*—These cross each other. The *anterior*[2]
(Fig. 46), arises from a roughness in front of
the spine of the tibia, and is inserted into the
posterior part of the internal face of the ex-
ternal condyle. The *posterior*[3] commences
at a roughness behind the spine of the tibia,
and is inserted at the anterior part of the
external face of the internal condyle of the
femur.

The synovial membrane is the most exten-
sive in the skeleton; it forms folds in the in-
terior of the joint, one of which is called the
*ligamentum mucosum*,[5] which is triangular in
shape, passing from the condyloid notch to
a mass of fat in front of the tibia. The *alar
ligamennts* are fringed folds of the synovial
membrane, containing masses of fat on each
side of the patella.

'ig. 46.

tibia and fibula are connected above by the
*rior Superior Ligament*[7] (Fig. 44).—A short, strong liga-
xtending obliquely between the heads of the two bones in

*rior Superior Ligament*[9] (Fig. 45).—Passes obliquely be-
he heads of the two bones behind. The synovial membrane
articulation is generally distinct from that of the knee-joint.
*osseous Ligament*[11] (Fig. 46).—Is stretched between the
d fibula throughout their entire length, and an opening at its
art transmits the anterior tibial artery.
*rior Inferior Ligament* (Fig. 48).—Is a broad band passing
ly between the two bones in front, and at their lower extre-

*rior Inferior Ligament.*—Is somewhat similar, passing
between the lower extremities of the two bones. Be
he tibia and fibula are united by short strong fibres, pa
e contiguous surfaces of the two bones.

## ANKLE JOINT.

It is the most perfect hinge in the body.

***Internal Lateral* or *Deltoid Ligament***[6] (Fig. 47).—Is triangular; its apex is attached to the internal malleolus, and its base to the os calcis, astragalus and calcaneo-scaphoid ligament. The tibialis posticis runs in a trochlea upon it.

*External Lateral Ligament*[6 7 8] (Fig. 48).—Consists of three parts, which arise from the external malleolus; the ***anterior*** passes forwards, and is inserted into the astragalus; the ***middle*** descends, and is inserted into the os calcis; the *posterior* passes backwards, and is fastened to the astragalus. The synovial membrane is large and loose, and is reflected upon some condensed cellular tissue in front, which is sometimes called the anterior ligament.

Fig. 47.

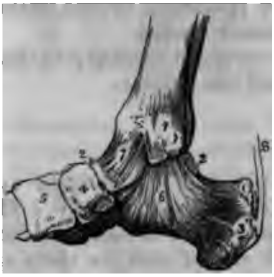
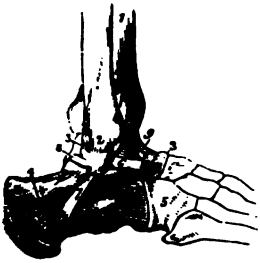


Fig. 48.



## ARTICULATIONS OF THE FOOT.

**The *astragalus* and *os calcis* are united by** a strong, thick, interosseous ligament, passing from the groove on the upper surface of the os calcis to the corresponding one of the astragalus.—*Posteriorly* there is a short ligament, called the *posterior* ligament, upon which plays the tendon of the flexor longus pollicis muscle.

**The *os calcis* and *scaphoid* are united** by the *superior calcaneo-scaphoid* ligament, which passes from the inside of the greater apophysis of the os calcis to the outside of the scaphoid; and by the *inferior calcaneo-scaphoid*, which occupies the triangular interval between the lesser apophysis of the os calcis and the tubercle of the scaphoid. Upon this rests a portion of the head of the astragalus.

**The *os calcis* and *cuboid* are united** by the *superior* calcaneo-cuboid ligament, which is a very thin flat band of fibres extending directly forwards from the os calcis to the cuboid, and by the *inferior* calcaneo-cuboid, which consists of two planes of fibres, of which the superficial or inferior layer is a strong band of pearly-white fibres,

ng from all the under surface of the os calcis to the groove
cuboid. The deeper-seated or superior layer, extends from
erior tuberosity of the os calcis obliquely to the ridge of the

*astragalus* and *scaphoid* are united by a thin semicircular
t, consisting of parallel fibres, extending from the neck of
ragalus to the margin of the concavity of the scaphoid.

*eiform Bones.*—They are united to each other and the sca-
by dorsal, plantar, and interosseal ligaments.

*Bases of the Metatarsal Bones.*—That of the first is united by
g capsular ligament with the internal cuneiform bone, having
ct synovial membrane. Those of the second and third are
with the middle and external cuneiform bone, by dorsal and
ligaments; those of the fourth and fifth by dorsal and planter
ts with the cuboid.

*heads of the metatarsal bones* are united to each other by a
transverse ligament; and to the phalanges by two lateral,
ntar, and an expansion of the extensor tendon.

*phalanges.*—Their ligaments are arranged similarly to those
hand, and consist of two lateral and one plantar.

## TEETH.

teeth are placed in the alveolar processes of the upper and
aw, and are the hardest portion of the human body. The
ent teeth are thirty-two in number, sixteen in each jaw; they
isible into four classes. On each side of each jaw there are
*isors,* one *cuspid,* two *bi-cuspid,* and three *molars;* each
onsists of a body or crown, which is the part exposed above
m; the neck, a narrow portion surrounded by the gum; and
or fang which is contained within the alveolus. The roots
rounded by a periosteum, and perforated at their extremities
ramen for the transmission of an artery and nerve.

*sors.*—Are next to the median line; their edge is bevelled,
early life serrated; the root is single and conoidal; those of
per jaw are larger than those of the lower jaw.

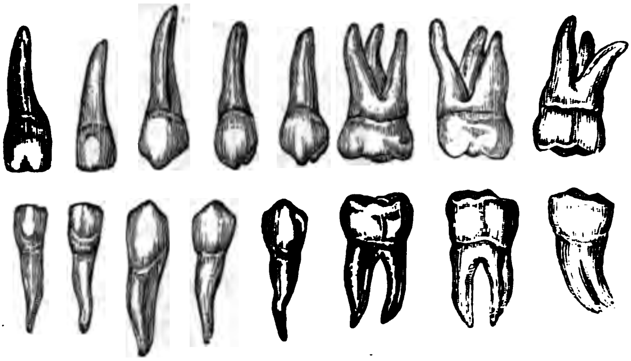
*id,* or Canine.—Is next to incisors. Its body is conoidal,
has the longest root. Those of the upper jaw are sometimes
eye-teeth, those of the lower jaw stomach-teeth.

*uspid.*—Are next in size to the molars. The body has
g points, of which the external is the larger. The roo
mes bifid and grooved upon either side. The anterior is
r.

*rs.*—They have large quadrilateral bodies, with four or
g points. In the upper jaw they have three divergent ro

two of which are external, and one is internal. In the lower jaw they have but two roots, which are anterior and posterior. The third molar or wisdom-tooth is smaller, and less perfectly developed than the other two, and does not appear until manhood.

Fig. 49.



*Structure.*—Each tooth has three textures, the *ivory* or *dentine*, the *enamel*, and the *cementum*.

The *ivory* forms the largest portion of the body, neck, and root, and gives form to the tooth. It is of a dull white colour, and harder than bone. Although apparently very compact, nevertheless it consists of numerous fine tubes (*dental tubuli*), the average diameter of which is about $\frac{1}{4500}$ of an inch. These tubes are larger at their commencement, which opens upon the pulp-cavity. They radiate in nearly parallel lines, and their finest ramifications sometimes terminate in minute cells or in loops. The tubular character is proven by the passage of ink and other fluids along them. The intertubular substance is translucent, and finely granular.

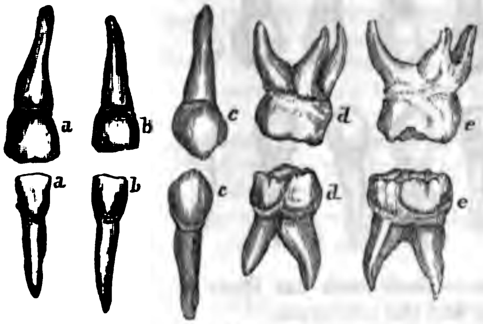
Dentine consists of 28 parts of animal, and 72 parts of earthy matter. The principal components are gelatine and phosphate of lime. It contains neither blood vessels nor nerves.

The *enamel* is the hardest portion; it encrusts the body; it is white, brittle, and semi-transparent, thicker upon the grinding surface, and terminates by a thin edge at the neck. Its structure consists of radiating hexagonal prisms of about $\frac{1}{500}$ of an inch in diameter: it possesses neither vessels nor nerves. It is composed of earthy matter almost entirely; so that the action of an acid leaves but a trace of the animal matter.

The *cementum* or crusta petrosa forms a thin coating over the root of the tooth, from the apex to the enamel. It resembles bone

ture, containing cells and canaliculi. It increases with the
in age, making the teeth of old persons appear to project.
*vity* exists in the body and fangs of the teeth, which is filled
*ulp*, principally composed of an artery, vein, and nerve,
enter at the small orifice at the point. The pulp-cavity
hes in adult life by the formation of cementum in its upper
hich prevents the exposure of the pulp even when the body
worn away.

Fig. 50.



nfant gum contains the rudiments of fifty-two teeth, in sepa-
ities; twenty of them appear between the sixth month and
ar of age, and fall out between the sixth and twelfth year;
e therefore called the *deciduous* or milk teeth, of which
e *two incisors, one cuspid*, and *two molars* on either side of
w. The order of the irruption is irregular, but the average
lows: at the seventh month, two middle incisors; ninth
two lateral; twelfth month, first molar; eighteenth month,
twenty-fourth, two last molars. The teeth of the lower
cede those of the upper by a short interval. The original
the tooth is a soft pulp contained in a sac, which pulp
ly becomes converted into dentine. The enamel is formed
uter wall of the sac. The cementum is formed by the peri-
of the tooth, which is the remains of the old sac.

## INTEGUMENTS, ETC.

### CELLULAR TISSUE.

ellular or areolar tissue is that substance found so univer
ted throughout the body. It serves for the purpose of
muscles and organs, and forming a protection, being

ticularly abundant beneath the skin. When parts are torn in a subject it is very distinct, and its characters can then be best observed. It will be found to be white in colour usually, and to consist of a number of cells which freely communicate, as is manifested in anasarca, emphysema, and ecchymosis. It is elastic and tough when fresh; when dried it is opaque and crisp; long boiling converts most of it into gelatine. Its *toughness* is due to one set of fibres, which are white, inelastic, and straight; of such most ligaments are formed. Its *elasticity* is due to another set of fibres, which are yellow, elastic, and curling; of such the ligamentum nuchæ and middle coat of arteries are composed.

It is very vascular, though most of its vessels do not contain red blood in health, as may be seen in inflammation produced by the air or any other stimulus. Its moisture is due to serum.

## FAT.

Fat is found in almost every part of the body, with the exception of the penis, ear, eyelid, and ball, interior of cranium, lungs, &c., &c., but in great abundance under the skin and around the serous membranes. It is of a yellowish colour, and in life is in a semi-fluid condition. It consists of three elements, stearine, margarine, and elaine, which are contained in vesicles aggregated in lobules, held together by areolar tissue. In women fat is more abundant; and in infants it is upon the surface of the body, rather than in the cavities.

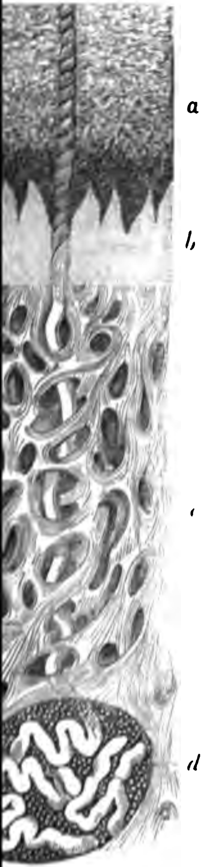
It is of use in diminishing pressure upon the hands and feet; retains heat, being a bad conductor, and assists in nutrition, as is manifested in hibernating animals.

## SKIN.

The skin is an external covering and protection, as well as an organ of touch and excretion. Its colour and thickness vary in different persons and in different parts of the same person. At the orifices of cavities it is converted into mucous membranes. The largest *wrinkles* are produced by the contractions of muscles, and by the flexion of joints; others of an angular variety, owing to the contractile character of the skin, are seen upon the back of the hand; the third variety is spiral.

The skin is perforated by hairs and perspiratory ducts, and contains sebaceous glands; these are considered as *appendages.* The skin consists of two layers, the true skin, also called cutis vera or chorion, and the cuticle or epidermis. The *cutis vera*[c] is the thicker and deeper of the two: it is white, and semi-transparent in all persons; its internal or inferior surface is much blended with the subjacent cellular tissue, and contains a number of pits or depressions; the external surface has a number of conical projections called *papillæ tactus,*[b] which are particularly numerous in those vhere there is much motion. On the hands and feet they are arranged in spiral and semicircular rows, which occasion a similar wrinkle of the cuticle. They consist of an artery, vein and nerve; the sensibility of a part is in ratio to their number. The skin itself is formed of condensed cellular tissue, the yellow fibrous element predominating where great elasticity is required, as in the armpit; the white element, where resistance is demanded, as in the sole of the foot. Between the interstices of these fibres pass innumerable vessels, ducts, &c., &c. It is thickened by pressure; boiling reduces it to gelatine; and tannin converts it into leather.

Fig. 51.

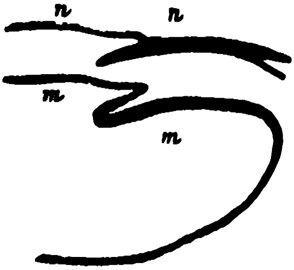


The *cuticle* or *epidermis*[a] affords protection to parts most exposed to pressure or friction; its thickness varies with the amount of pressure to which it is subjected, as is seen by the comparison of the hand of the artisan with that of a delicate female. It is not permeated by vessels or nerves, but consists of particles arranged in different laminæ; those that are deepest are granular, those of the next layer are more compressed, whilst those upon the surface are mere scales. These superficial scales, which are horny, are constantly being shed, and new particles constantly supplied by the moist granules, which are below. The laminated condition makes it easy to divide into different layers, and the inferior layer was formerly called by a distinct name, *rete mucosum;* but it is nothing more than the deepest or most recently-formed part of the cuticle, in which are cells containing louring matter: this is very abundant in moles, freckles, and skin of negroes.

## NAILS.

*nails* are modifications of the epidermis. Their appearance familiar to every one to demand description. That portion is concealed is called the *root;* that which is free or projecting, the *edge*; that attached to the surface of the cutis is the *body*. The *matrix* is that portion of the cutis under the root and body, which produces the nail. The *lunula* is that crescentic, white portion of the matrix near the root, and is due to a different arrangement of the capillaries in that part of the matrix. The nail firmly adheres to the matrix, and is moulded upon it like the epidermis in other situations. The epidermis or cuticle is *continuous* with the nail, and neither passes over or under it; being essentially of the same structure. By maceration the epidermis and nail[n n] can readily be removed from the *cutis vera*.[m m] The border of the root of the nail is jagged, thin, and soft, and consists of newly-formed substance; the deep surface of the body is also soft, and marked by longitudinal grooves corresponding to the papillary ridges on the surface of the matrix; but the edge and superficial portion of the nail is composed of scales more dense and fibrous.

Fig. 52.



## HAIRS.

*Hairs* are found on all parts of the surface, except the palms of the hands, and soles of the feet; and vary in length, thickness, shape, and colour, according to situation, age, sex, or race. The *shaft* is that portion projecting beyond the surface; the *bulb* is that extremity contained in a follicle of the skin. The cuticular lining of this follicle is continuous with the bulb itself, there being a gradual change in the scales, as they pass from the follicle into the hair bulb; the hair itself grows from the bottom of the follicle, like the nail from the matrix, or the epidermis from the cutis. If the hair is to be coloured, pigment-granules are here also deposited.

The *human* hair is a *rod*, and not as commonly supposed, a tube. The scales in the axis of the hair are softer, and not so closely condensed as those of the surface, and thus they contain a larger amount of pigment in the interstices, which produces that dark appearance which is mistaken for a tube; this softer portion situated in the middle, is sometimes called the *medulla*, and the condensed, fibrous exterior is termed the *cortex*; the scales of which are imbricated, that is, they overlap each other like the shingles of a roof. Where the hairs are large, and especially wi[illegible] organs, there may be a papilla in the bottom of [illegible] with nerves and vessels, which projects in[illegible] whiskers of a cat, and the quills of a porcupine [illegible] this papillary projection may be seen in [illegible], but their size is much overrated.

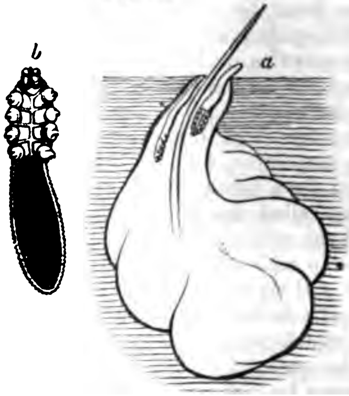
hairs maintain a vital, though not a vascular connexion with ly; the moisture is partly due to the sebaceous glands, whose on passes through them by capillary attraction. Mental n has occasioned the hair to become white in a single night; ccount for this by a secretion of fluid acid which percolates ue of the hair, and chemically destroys the colour. Ordinary air resembles other hair in every respect, save that of colour.

### SWEAT GLANDS.

e are found in great number upon the inferior surface of the ra generally. In the axilla they form a layer, an eighth of thick, which is mammillated, and of a reddish colour. They ut the size of a pin's head, are soft, and often compressed rounded by a network of capillary blood-vessels. They are ishable from pellets of fat by their pink colour, and semirent texture. When magnified, they are seen to consist of a tube, intricately ravelled, one end of which is closed, and within the gland, and the other (Fig. 51), opens upon the The duct consists of two portions: the *dermic* part winds sly through the true skin, and terminates in a funnel-shaped g between the papillæ tactus; the *epidermic* portion comat the lower part of the cuticle, at first very indistinctly and t any defined continuity of structure with the duct below, lly assuming the spiral form, and having the scales of which ls are composed arranged parallel with the axis of the pas-The secretion varies in odour in different portions of the nd in different races.

### SEBACEOUS GLANDS.

Fig. 53.



The *sebaceous glands* are found in most parts of the skin, except in the palms and soles; they are most abundant on the scalp and face, especially about the nose. The orifices open into hair follicles, or upon the general surface. They consist of a duct, terminating in a blind, pouch-like ex mity, lined by an thelium, in the part of which are incl granules of sebac matter. The secre is subservient for lubrication of the hair and the skin. There are generally found in their ducts, parasites, of which two specimens are given in *b* and *c*,

Fig. 54.

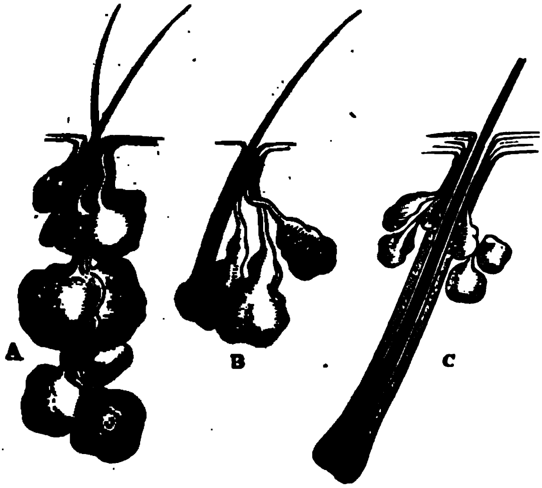


Fig. 53. These animals are found in almost every individual, especially in those possessing a torpid skin; and they multiply in sickness.

The ceruminous glands of the ear resemble the sebaceous glands.

## SECTION III.

## MUSCLES.

MUSCLES are formed of that substance usually called *flesh*, which has a peculiar contractile power, producing motion; they consist, independently of the cellular tissue, vessels, and nerves, which enter into their formation, of a special tissue. Those muscles which are excited by the will, such as those of locomotion, are called *voluntary*. Those which act independently of the will, such as those of the intestines and uterus, are called *involuntary*. *Voluntary muscle* is composed of a number of bundles of fibres, called fasciculi or lacerti.

The fibres are about $\frac{1}{400}$ of an inch in diameter, and are crossed by regular transverse striæ, which give rise to the term "striped," as applied to the voluntary muscles; although there are some striped muscular fibres found in organs which are involuntary, as in the case of the heart, pharynx, and upper part of œsophagus.

Each fibre consists of a number of filaments or fibrillæ, included in a tubular sheath, formed of a tough, delicate, elastic membrane, the sarcolemma. Each fibrilla consists of a number of ngular particles, arranged in a linear series, and called *sarelements.*

blood-vessels pass in between the fasciculi, and terminate in llary network, which passes between the fibrillæ.

nerves also penetrate the fasciculi, and terminate in loops, do not penetrate the sarcolemma of the fibres.

*luntary* muscles consist of pale "unstriped" fibres, with the ex- of the heart and gullet. They are generally flattened, and oubtful whether they have a sarcolemma. They are much r than the striped fibres, being not more than $\frac{1}{2500}$ part of h in diameter. The chief constituent of muscle is fibrin.

red colour of muscles is not altogether dependent upon the ry vessels, but upon a peculiarity of colouring matter united hem.

ry muscle has a belly and two extremities; that which is s called the *origin* or *head;* that which is moveable, the *in-*. Those which surround orifices, are called *sphincters.*

*ndon* is formed of condensed white fibrous tissue, reaching he end of a muscle to some structure which it is intended to

further description, see "Physiology."

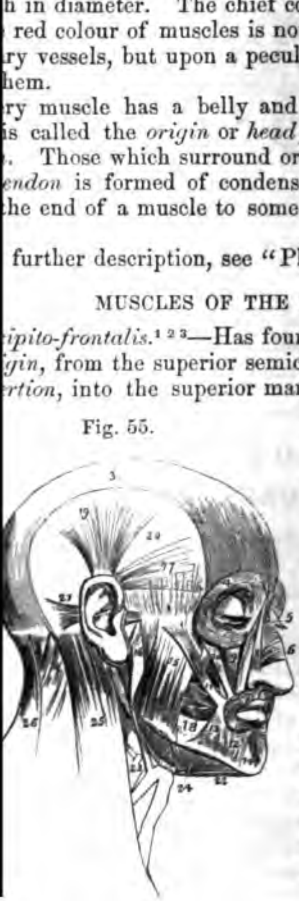
## MUSCLES OF THE HEAD AND NECK.

*ipito-frontalis.*[1 2 3]—Has four bellies.

*gin,* from the superior semicircular ridges of the occiput.

*rtion,* into the superior margin of the orbicularis oculi, and corrugator supercilii, and into the internal angular process of the os frontis and os nasi. *Use;* it elevates the eyebrows, making transverse wrinkles.

Fig. 55.



*Compressor Naris.*[6]—*Origin,* from the root of the ala nasi. *Insertion,* tendinously into its fellow on the dorsum of the nose, and into the lower part of the os nasi. *Use;* it either compresses or dilates the nostril.

*Orbicularis palpebrarum.*[4]—This is a sphincter surrounding the orbits of the eyes. *Origin,* from the nasal process of the superior maxillary, the os unguis, the internal angular process of the os frontis, and the internal palpebral ligament. *Insertion,* into the orbitar and nasal processes of the superior maxillary, and into the palpebral ligament. *Use;* it closes the eyes.

That portion of the muscle immediately covering the eyelids is called *ciliaris.*

*Corrugator supercilii.*—A narrow, small, and pointed muscle, beneath the occipito-frontalis. *Origin:* internal angular process of the os frontis.—*Insertion,* into the occipito-frontalis and orbicularis. *Use;* it makes vertical wrinkles of the forehead.

*Levator Labii superioris alæque Nasi.*[8]—It lies on the side of the nose. *Origin,* from the nasal and orbitar processes of the superior maxillary bone. *Insertion,* into the upper lip and wing of the nose. *Use;* it elevates the wing and sides of the nose.

*Levator anguli Oris.*[9]—Small and concealed by the last. *Origin,* from the superior maxillary bone, below the infra orbitar foramen. *Insertion:* corner of the mouth. *Use;* elevates the angle of the mouth.

*Zygomaticus minor.*[10]—*Origin,* from the malar bone. *Insertion,* into the upper lip. *Use;* it raises the upper lip outwardly.

*Zygomaticus major.*[11]—*Origin,* from the malar bone, behind the last. *Insertion,* into the corner of the mouth. *Use;* it draws the mouth obliquely upwards and outwards.

*Depressor Labii superioris alæque Nasi.*—Very much concealed. *Origin,* from the alveolar processes of the incisor and canine teeth. *Insertion,* into the wing of the nose and upper lip. *Use;* depresses the upper lip and wing of the nose.

*Depressor anguli oris.*[12]—*Origin,* from the base of the lower jaw, on the side of the chin. *Insertion,* into the corner of the mouth. *Use;* it draws the mouth downwards.

*Depressor Labii Inferioris.*[13]—*Origin,* from the base of the lower jaw, beneath and in front of the last. *Insertion,* into the whole side of the lower lip. *Use;* it draws the lip downwards.

*Levator Menti.*[14]—Is much concealed, and best viewed from the inside of the lip. *Origin,* from the alveolar processes of the lateral incisor and canine teeth. *Insertion,* into the lower lip. *Use;* it elevates the lip.

*Buccinator.*[18]—*Origin,* from the coronoid process of the lower jaw, from the tuber of the upper jaw, and alveolar processes of both jaws. *Insertion,* corner of the mouth and lips. *Use;* it draws the mouth backwards, and presses the food between the teeth.

*Orbicularis oris.*[7]—Is a circular muscle surrounding the mouth, has neither bony origin nor insertion, but is much connected with other muscles of the mouth.

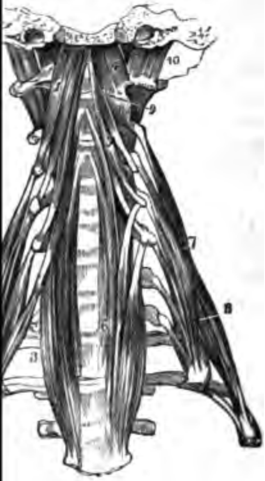
*Masseter.*[15] [16]—*Origin,* from the superior maxillary and malar bones, and also from the zygoma of the temporal bone. *Insertion,* into the angle and external surface of the lower jaw. *Use;* it draws the jaw upwards and backwards. It is very strong, and consists of two planes of fibres.

*Use;* it draws the hyoid bone upwards, and projects the
.

*io-hyoideus.*[6]—*Origin,* from the posterior tubercle, inside of in. *Insertion,* into the body of the hyoid bone. *Use;* it it upwards and forwards.

*gus-colli.*[3 5 6]—*Origin,* from the bodies of the three superior vertebræ, and the transverse processes of the five lower cervical. *Insertion,* into the bodies of all the cervical vertebræ. *Use;* it bends the neck forwards and to one side.

Fig. 58.



*Rectus capitis anticus major.*[2]—(See Fig. 58.) *Origin,* from the transverse processes of the third, fourth, and fifth cervical vertebræ. *Insertion,* into the basilar or cuneiform process of the occiput. *Use;* it bends the head forwards.

*Rectus capitis anticus minor.*[4]—*Origin,* from the atlas near its transverse process. *Insertion,* into the basilar process of the occiput. *Use;* it bends the head forwards.

*Rectus capitis lateralis.*[10]—*Origin,* from the transverse process of the atlas. *Insertion,* between the condyle and jugular eminence of the occipital bone. *Use;* it draws the head to one side.

*Scalenus anticus.*[9]—*Origin,* from nsverse processes of the fourth, fifth, and sixth cervical ver- tendinously. *Insertion,* into the upper surface of the first front of the groove for the subclavian artery. *Use;* it bends ck forwards, or raises the first rib.

*lenus medius.*[7]—*Origin,* from the transverse processes of all rvical vertebræ tendinously. *Insertion,* into the upper sur- the first rib, behind the groove for the artery. *Use;* same
.

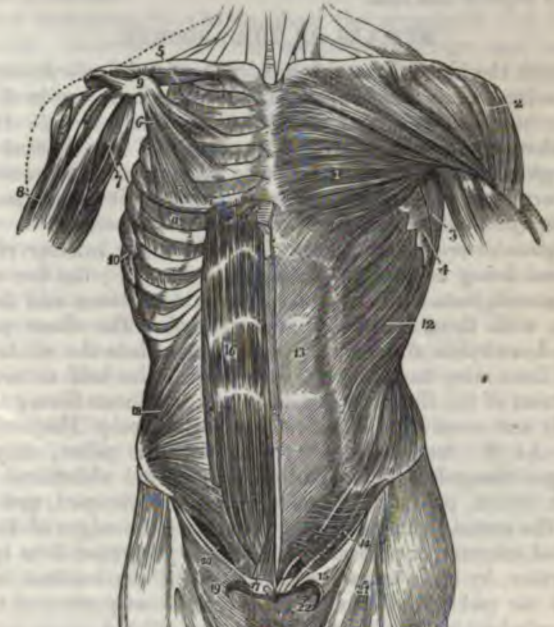
*lenus posticus.*[8]—*Origin,* from the transverse processes of the nd sixth cervical vertebræ. *Insertion,* into the upper face of cond rib beyond the tubercle. *Use;* it bends the neck and the second rib.

## MUSCLES OF THE CHEST.

*oralis major.*—Forms the cushion of the chest. *Origin,* from o upper bones of the sternum, the sternal two-thirds of the clavicle, the cartilages of the fifth and sixth ribs, and from the tendon of the external oblique muscle. *Insertion*, into the outer edge of the bicipital groove of the humerus. *Use;* it draws the arm inwards and forwards.

*Pectoralis minor.*[6]—*Origin*, from the third, fourth, and fifth ribs. *Insertion*, into the inner face of the extremity of the coracoid process of the scapula. *Use;* it draws the scapula inwards and downwards.

Fig. 59.



*Subclavius.*[5]—*Origin*, from the cartilage of the first rib. *Insertion*, into the inferior face of the clavicle. *Use.* It draws the clavicle downwards.

*Serratus magnus, or anticus.*[4]—*Origin*, from the nine upper ribs, five of its heads interdigitating with the external oblique muscle. *Insertion*, into the whole length of the base of the scapula. *Use.* It draws the scapula forwards.

*Intercostales externi.*[11]—There are eleven on each side. *Origin*, from the transverse process of the vertebra, and the inferior sharp

' the rib. *Insertion*, into the superior rounded edge of the
ow. The fibres pass obliquely downwards and forwards.
*costales interni*.—Also eleven on each side. *Origin*, from
erior edge of the rib, and costal cartilages. *Insertion*, into
erior rounded edge of the rib below, the fibres passing down-
nd backwards. *Use*. To approximate the ribs.
*ngularis sterni*.—Situated on the inner wall of the front of
st. *Origin*, from the ensiform cartilage, and second bone of
rnum. *Insertion*, into the third, fourth, fifth, and sixth ribs.
o depress the ribs.

## MUSCLES OF THE ABDOMEN.

ath the skin of the abdomen is the *fascia superficialis abdo-*
a layer of condensed cellular substance, varying in thickness
rent individuals, and containing more or less fat. Its lami-
haracter admits of its being dissected into several layers.
groin it encloses the lymphatic glands, and is traversed at its
art by the *arteria ad cutem abdominis*; it is thickened over
physis pubis, and constitutes the *mons veneris*.
*quus externus*.[12]—*Origin*, from the eight inferior ribs, the
ad being covered by the pectoralis major; the five superior
nterdigitate with those of the serratus anticus, and the three
', with those of the latissimus dorsi. The fibres pass ob-
downwards and forwards. *Insertion*, into the whole length
linea alba, tendinously; into the anterior half or two-thirds
rest of the ilium, by muscular and tendinous fibres; and into
y and crest of the pubes, forming thereby Poupart's liga-
As the tendinous fibres approach the pubes, they split,
; a triangular opening called the external abdominal ring;[13]
which passes in the male the spermatic cord, and in the
the round ligament of the uterus. The edges of this ring
ed columns or pillars.—This ring is prevented from splitting
ther, by some transverse tendinous fibres inserted into the
' the pubis.[14] The external edge of that portion of the ten-
alled Gimbernat's ligament. (Fig. 59.)
—It compresses the viscera of the abdomen, and approxi-
he pelvis and thorax.
*quus internus*.[15]—*Origin*, from the three inferior spinous
es of the lumbar vertebræ, and from all those of the sacrum,
e whole length of the middle lip of the crest of the ilium,
m the outer half of Poupart's ligament. *Insertion*, into the
rior ribs, into the ensiform cartilage, into the whole length
*linea alba*, and also tendinously into the pubes behind
l abdominal ring. At the linea semilunaris, the te
to two laminæ, which thereby form a sheath for the r
; in the lower third or fourth of the muscle, both la
r, pass in front, and include between them the pyrami

*Transversalis abdominis.*—Is beneath the last. *Origin*, from the transverse processes of the last dorsal and four upper lumbar vertebræ, from the internal lip of the crest of the ilium, and from the external half of Poupart's ligament; it also arises from the cartilages of the six inferior ribs. *Insertion*, into the ensiform cartilage, linea alba, and pubes, in common with the internal oblique tendon. A portion of this common tendinous insertion is also into the crest of the pubes immediately behind the external abdominal ring, and thus the weakness at this part of the abdomen is in some measure protected.

*Rectus abdominis.*[16]—*Origin*, from the symphysis and body of the pubes. *Insertion*, into the ensiform cartilage, and into the cartilages of the fifth, sixth, and seventh ribs. This muscle gradually increases in breadth and has tendinous intersections called *lineæ transversæ*, which are three or four in number.

*Pyramidalis.*[17]—Is in front of the lower part of the rectus, and about three inches in length. *Origin*, from the body of the pubes. *Insertion*, into the linea alba. It is sometimes wanting.

*Cremaster.*—This muscle forms a muscular sheath for the cord and upper part of the testicle; before the descent of the testicle, it constitutes the inferior edge of the internal oblique and transversalis muscles, which are much blended at this part; hence its *origin* may be said to be the muscular portion of the lower edge of these muscles, and that its *insertion* is into the conjoined tendon of these muscles.

*Fascia transversalis.*—This fascia covers the abdomen, and lies under the muscles and in front of the peritoneum; it is continuous with the *iliac fascia*, which surrounds the posterior part of the peritoneum, and with the *pelvic fascia*, which surrounds that portion of peritoneum in the cavity of the pelvis. It is thin and tough, and near the groin possesses great density.

This fascia is an object of study, particularly on account of the *internal abdominal ring* being situated in it. This point is usually much misunderstood, partly from the use of the term *ring*, which gives rise to the idea that it is a hole or opening like the external ring, and partly from the variety and confusion of terms employed in its description. It may be said to be that portion of the fascia transversalis where it ceases to cover the abdomen and commences to cover the cord; here it is very thin, and an artificial or false dissection readily can form a ring or hole with a well-defined edge. But such does not exist in nature, for the fascia is continued from the abdomen upon the cord.

### INGUINAL HERNIA.

Inguinal hernia is of two kinds; oblique or indirect, and direct or ventro-inguinal hernia. Oblique is by far the most common; and

f the rib. *Insertion*, into the superior rounded edge of the
ow. The fibres pass obliquely downwards and forwards.
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## INGUINAL HERNIA.

Inguinal hernia is of two kinds; oblique or indirect, and direct or ventro-inguinal hernia. Oblique is by far the most common; and

r to understand the anatomy of it, it will be necessary to bear
d the arrangement of the parts previous to the descent of the
, the subsequent and natural condition, and also the alteration
parts by the hernial protrusion.

*que* inguinal hernia is a protrusion of intestine through a pas-
iginally made by the escape of the testicle from the loins to
otum; and afterwards occupied by the spermatic cord. Until
enth month of fœtal life the testicle reposes in the lumbar
beneath the kidney, but not within the cavity of the perito-
As yet there is no spermatic cord formed, the constituents,
the artery, vein, duct, &c., each approaching the testicle
ely. About this period the testicle ordinarily descends, by
of the *gubernaculum testis* a contractile structure attached to
rior extremity, and is enveloped in the scrotum. In its pas-
must come in contact with the various structures forming the
of the abdomen, viz., the peritoneum, fascia transversalis,
nsversalis, internal and external oblique muscles, the super-
scia, and the skin. Now each of these structures, with the
on of the external oblique muscle, will be found to form a
g for the testicle and cord, because it does not perforate them
hes them before it; although these coverings may be modi-
some degree, nevertheless there is a representation of every
f the walls of the abdomen; and this is the case not only in
erings of the testicle and cord, but also in the coverings of
a protrusion; hence, if a student understands the changes
ake place in the descent of the testicle, he must necessarily
and the mode by which this kind of a hernial protrusion
its coverings.

we must caution students from attaching too much impor-
words or terms used in description, for they vary with diffe-
iters; but let him keep constantly before his mind the thing
s if he were making a dissection; for by actual dissection he
derstand it thoroughly, although he may not know the name
gle part.

*ent of the testicle*.—In the first place, by the contraction of
ernaculum testis, the testicle is brought in contact with the
eum, and since it is not in the peritoneal cavity, it must
rily push before it a doubled lamina of peritoneum. Thus
icle gets a covering of serous membrane arranged as serous
nes always are; that is, one lamina covers the testicle, and
r lines the cavity in which it is contained, and it is called
*itestis* or *tunica vaginalis testis*. The communication between
itoneum and peritestis is afterwards obliterated, otherwise
ould readily pass down; and when this obliteration doe
nd the bowel does pass down, it constitutes a variety of
ned *congenital*. As the testicle descends, the spermatic ar

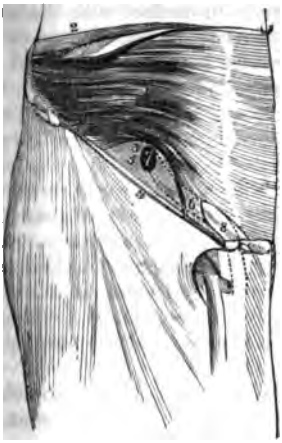
vein, and vas deferens descend with it, and thus the cord is formed; the components are held together by means of cellular tissue, the remains of the canal of peritoneum, connecting the peritoneum and peritestis. Organs that have been of use in the system are never entirely absorbed, but converted into another, which serves a different purpose—as in the case of an artery when tied for aneurism, it becomes a cord; the umbilical vein becomes the ligamentum teres.

Now, the next structure with which the testicle comes in contact, is the fascia transversalis; let us follow this in its descent with the testicle, and observe the changes which it undergoes. It is not perforated as this (Fig. 60) and most pictures represent,[7] but pushed before the testicle, covering it and the cord. The point where this protrusion takes place, is midway between the anterior superior spinous process of the ilium and the pubes, and about an inch and a half above Poupart's ligament, and is called the *internal abdominal ring;* but there is no hole or opening unless made with a scalpel. The fascia is continuous from the abdomen upon the cord, although that portion covering the abdomen is tougher and thicker than that of the cord. If the cord is stretched, this portion of the fascia will resemble a funnel, and hence some call it the *infundibuliform fascia* or *internal spermatic fascia.* That portion which covers the testicle, assists in forming its cellular coat, which is termed by some *tunica vaginalis communis testis,* by others, the *fascia propria.*

Terms are matters of minor importance; the truth to be taught is, that the testicle, cord, and abdomen are invested by the same fasciæ, having different names and different thicknesses in different parts.

The next layer of the abdominal wall with which the testicle comes in contact is the *transversalis muscle.* At the lower part of the abdomen, the internal oblique is so much blended with the transversalis, that the two may be considered as having the same relation to the testicle in its descent, and also to hernia. At the internal abdominal ring, the testicle, already covered by the peritoneum and fascia transversalis, comes in contact with these muscles; it does not perforate them, but pushes their conjoined lower edge before it, obtains for itself and cord a muscular covering,

Fig. 60.



s the *cremaster* muscle; and this accounts for that looped nce which the fibres of this muscle have upon the testicle; r the muscle being thicker upon the anterior part of the cord. nuscular fibres are very pale, and very scattered upon the art of the testicle, and form an imperfect covering for the

When the cremaster is cut away from the transversalis ernal oblique, their inferior edge presents an arched appear-

tendon of the external oblique is the next structure opposing ent, and since this is very tough, it is not pushed before the ; but the testicle passes obliquely downwards and inwards nch and a half, until it gets opposite the external abdominal hich is a hole, and at which it emerges between its columns rs. The fact, that in health these two rings are not opposite tes much to the strength of the arrangement, and prevents e frequent occurrence of hernia, which is much favoured by ency in the fibrous character of the tendon of the external .

space between these two rings, is called the *inguinal, abdo-* or *spermatic canal.* It is bounded anteriorly by the inferior the internal oblique and transversalis muscles, the tendon of ernal oblique, the superficial fascia, and skin; posteriorly by nsversalis fascia, and the conjoined tendon of the transversalis ernal oblique muscles; inferiorly, by Poupart's ligament.

n the hernia does not emerge from this canal, it is called a *d* inguinal hernia.

e external abdominal ring, the testicle, with its covering, n contact with the superficial fascia, which has already been d as consisting of numerous laminæ, one of which can be shown to extend between the columns of the ring, and is called the *intercolumnar fascia*, by some, by others, the *l spermatic*, &c. That portion of the fascia transversalis en- n forming the cellular coat of the testicle, is actually blended e superficial fascia of the testicle, on account of the intermuscular structure, that of the cremaster being deficient in rts, and very spare in others.

skin is, of course, readily traced from the abdomen to the , although in the scrotum it is modified by the dartos, which, ng to some, is an expansion of the gubernaculum testis.

have seen the changes which take place in the descent of icle, and are now prepared to consider the escape of the in-

convolution or knuckle of intestine first presses against um, and being contained within the cavity, can only pr t a single lamina. This portion of the peritoneum al forms the *hernial sac*, which gradually increases in size and thickness. In this variety of hernia (oblique inguinal), the protrusion takes place at the internal ring; the sac must then necessarily be covered by the transversalis fascia and cremaster muscle, and after passing obliquely down the inguinal canal, it emerges at the external abdominal ring, where it receives an investment of superficial fascia and skin.

That portion of the superficial fascia which fills up the external abdominal ring between its columns, and called intercolumnar, when pressed against by the protrusion is thickened and expanded.

When a hernia exists, the connexion between this fascia and the edges of the external abdominal ring is so close that the tendon of the external oblique seems to be continued into the fascia; and some have therefore considered it as derived from the tendon, and not from the superficial fascia, as we have described; and indeed we frequently find, even when no hernia exists, a thin layer extending from the tendon of the external oblique to the spermatic cord.

Hence, in the operation for hernia, the following layers are cut through:—

*Skin, superficial fascia, intercolumnar fascia, cremaster muscle, transversalis fascia*, and *the hernial sac.*

That portion of the fascia transversalis which covers the hernial sac is also thickened, and often called the *infundibuliform fascia*, or the *internal spermatic fascia.*

In the dissection of a hernial sac, we will find alterations in thickness and colour, the consideration of which properly belongs to the surgical part of this work.

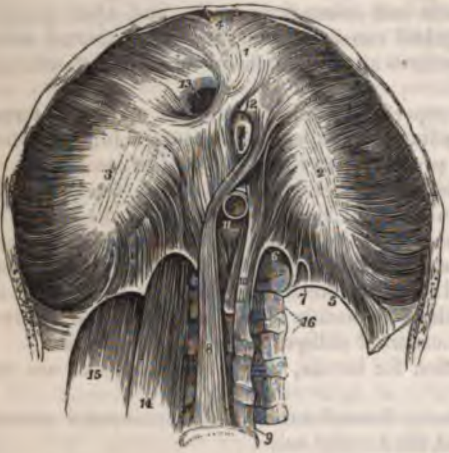
*Direct* or *ventro-inguinal hernia* consists of a protrusion directly at the external abdominal ring, and of course it does not pass through the canal. The coverings are the *skin, superficial fascia, intercolumnar fascia*, the common *tendon* of the *internal oblique* and *transversalis* muscles, *transversalis fascia*, and hernial *sac*.

This variety is not of so frequent occurrence, on account of the insertion of the tendon of the internal oblique and transversalis into the pubes immediately behind the external abdominal ring, which protects this opening, and therefore it must be ruptured or expanded when a protrusion takes place at this ring; when it is ruptured, of course this covering of the sac does not exist.

## MUSCLES OF THE UPPER AND POSTERIOR PART OF THE ABDOMEN.

*Diaphragm.*—This muscle forms the septum between the thorax and abdomen; it consists of two parts, a greater and lesser muscle.

Fig. 61.



The *greater*[1,2,3] muscle arises from the ensiform cartilage, from the ligamentum arcuatum,[5] which is a tense ligament passing from the root of the transverse process of the first lumbar vertebra to the inferior part of the middle of the twelfth rib, and from six inferior ribs; the fibres converge to the cordiform tendon, which is in the centre. Between its costal and ensiform origin there is a small triangular fissure filled up with fat, which sometimes leaves an opening for hernia. The *lesser*[8,10] muscle consists of two bellies, which are called *crura*, the right of which is the larger. *Origin*, from the second, third, and fourth lumbar vertebræ. *Insertion*, into the cordiform tendon.

There are *three openings* in the diaphragm; one in the tendinous centre,[13] called *foramen quadratum*, which transmits the ascending *vena cava;* another, an elliptical muscular opening,[12] called *foramen œsophageum*, through which passes the œsophagus, and the par vagum nerves; and the third, the *hiatus aorticus*,[11] which is between the crura, and in front of the vertebra; through it pass the aorta, the thoracic duct, the azygos vein, and the great splanchnic nerve. *Use;* it widens the thoracic, and diminishes the abdominal cavity.

*Quadratus lumborum.—Origin*,[15] from the crest of the ilium. *Insertion*, into the transverse processes of the last dorsal and all the lumbar vertebræ, and also into the last rib beneath the ligamentum arcuatum. *Use;* it bends the loins to one side.

*Psoas parvus.*—Not always present. *Origin*, from the last dorsal and first lumbar vertebræ. *Insertion*, by a long tendon, into the *crest of the pubes* and *fascia iliaca.*

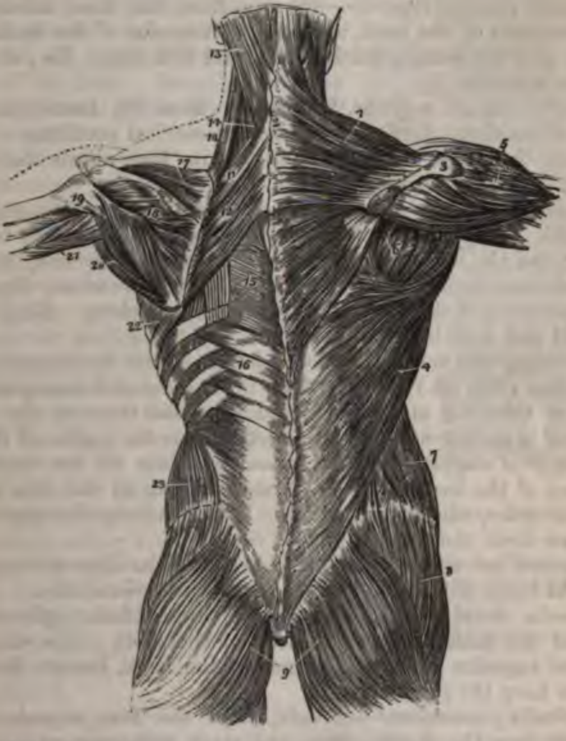
*Psoas magnus.*[14]—*Origin*, from the transverse processes of all the lumbar vertebræ, and from the bodies of the four upper lumbar and last dorsal vertebræ. *Insertion*, into the lesser trochanter of the femur, and into one inch below it.

*Iliacus internus.—Origin*, from the transverse process of the last lumbar vertebra, from the costa and crest of the ilium, and from the capsule of the hip joint. *Insertion*, into the tendon of the psoas magnus. *Use;* the action of the last two muscles is the same, to bend the body forwards and draw the thigh upwards.

## MUSCLES OF THE BACK.

*Trapezius.*[1]—*Origin*, from the superior semicircular ridge of the occiput, from all the spinous processes of the neck, by means of the ligamentum nuchæ, and from all those of the back. *Insertion*, into the external third of the clavicle, into the acromion process, and spine of the scapula. *Use;* it draws the scapula towards the spine.

Fig. 62.



*Latissimus dorsi.*[4]—*Origin*, from the seven inferior spinous processes of the back, and from all those of the loins and sacrum, also from four inferior ribs, by heads which interdigitate with those of the external oblique. *Insertion*, by a thick flat tendon, in common with the *teres major*, into the posterior ridge of the bicipital groove. *Use;* it draws the humerus downwards and backwards.

*Serratus posticus inferior.*[16]—*Origin*, from the two inferior spinous processes of the back, and the three superior of the loins. *Insertion*, into the last four ribs. *Use;* it draws the ribs downwards.

*Rhomboideus minor.*[11]—*Origin*, from the three inferior spinous processes of the neck. *Insertion*, into the base of the scapula opposite the spine.

*Rhomboideus major.*[12]—*Origin*, from the spinous processes of the last cervical, and of the four superior dorsal vertebræ. *Insertion*, into the base of the scapula below the spine. *Use;* the last two draw the scapula upwards and backwards.

*Serratus posticus superior.*—*Origin*, from the three inferior spinous processes of the neck, and the two superior of the back. *Insertion*, into the second, third, fourth, and fifth ribs. *Use;* it draws the ribs upwards.

*Levator anguli scapulæ.*[10]—*Origin*, from the transverse processes of the three, four, or five superior cervical vertebræ. *Insertion*, into the angle of the scapula, and its base above the spine. *Use;* it draws the scapula upwards.

*Splenius.*[13 14]—It consists of two parts; splenius capitis and splenius colli. *Origin*, from the spinous processes of the five inferior cervical and the four superior dorsal vertebræ. *Insertion*, into the occipital bone, between the two semicircular ridges, and into the transverse processes of the two superior cervical vertebræ. *Use;* draws the head and neck backwards.

*Sacro-lumbalis* and *longissimus dorsi.*—These two muscles arise in common (Fig. 63.) *Origin*, from the spinous and transverse processes of the loins and sacrum, and from the crest of the ilium. The first[2] is on the outer side. *Insertion*, into the angles of the rib. The latter[3] is nearest the spine. *Insertion*, into all the transverse processes of the back except the first, and into all the ribs beyond their tubercles, except the last two. *Use;* to keep the spine erect, and draw down the ribs.

*Accessorii ad sacro-lumbalem.*—Are muscular slips arising from the eight lower ribs and continued into the sacro-lumbalis.

*Spinalis dorsi.*[4]—*Origin*, from the three inferior spinous processes of the back, and two superior of the loins. *Insertion*, into the nine superior spinous processes of the back, except the first. *Use;* to keep the spine erect.

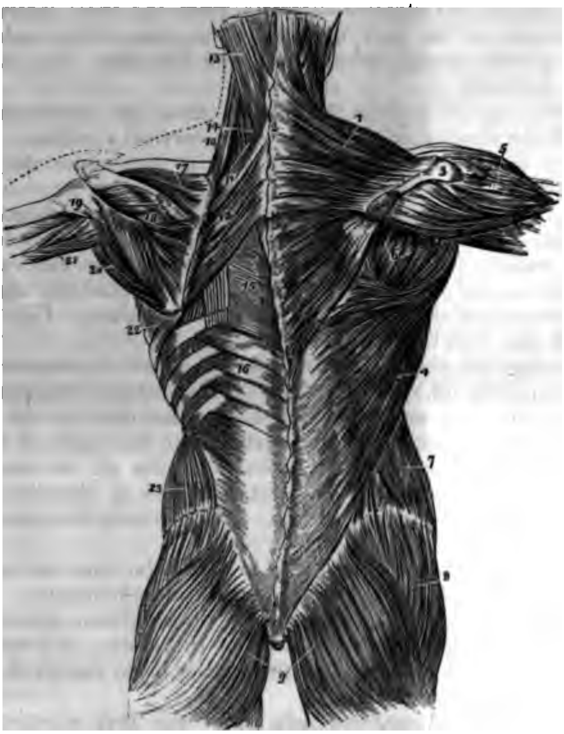
*Cervicalis descendens.*[5]—*Origin*, from the four superior ribs. *Insertion*, into the fourth, fifth, and sixth transverse processes of the neck.

*Transversalis cervicis.*[6 9]—*Origin*, from the five superior translast lumbar vertebra, from the costa and crest of the ilium, and from the capsule of the hip joint. *Insertion,* into the tendon of the psoas magnus. *Use;* the action of the last two muscles is the same, to bend the body forwards and draw the thigh upwards.

## MUSCLES OF THE BACK.

*Trapezius.*[1]—*Origin,* from the superior semicircular ridge of the occiput, from all the spinous processes of the neck, by means of the ligamentum nuchæ, and from all those of the back. *Insertion,* into the external third of the clavicle, into the acromion process, and spine of the scapula. *Use;* it draws the scapula towards the spine.

Fig. 62.



*Latissimus dorsi.*[4]—*Origin,* from the seven inferior spinous processes of the back, and from all those of the loins and sacrum, also

our inferior ribs, by heads which interdigitate with those of
ernal oblique. *Insertion*, by a thick flat tendon, in common
e *teres major*, into the posterior ridge of the bicipital groove.
t draws the humerus downwards and backwards.

*atus posticus inferior.*[16]—*Origin*, from the two inferior
processes of the back, and the three superior of the loins.
*m*, into the last four ribs. *Use;* it draws the ribs downwards.

*nboideus minor.*[11]—*Origin*, from the three inferior spinous
es of the neck. *Insertion*, into the base of the scapula oppo-
spine.

*nboideus major.*[12]—*Origin*, from the spinous processes of the
vical, and of the four superior dorsal vertebræ. *Insertion*,
e base of the scapula below the spine. *Use;* the last two
e scapula upwards and backwards.

*atus posticus superior.*—*Origin*, from the three inferior spi-
ocesses of the neck, and the two superior of the back. *In-*
into the second, third, fourth, and fifth ribs. *Use;* it draws
upwards.

*tor anguli scapulæ.*[10]—*Origin*, from the transverse pro-
of the three, four, or five superior cervical vertebræ. *Inser-*
to the angle of the scapula, and its base above the spine.
draws the scapula upwards.

*nius.*[13 14]—It consists of two parts; splenius capitis and sple-
lli. *Origin*, from the spinous processes of the five inferior
and the four superior dorsal vertebræ. *Insertion*, into the
l bone, between the two semicircular ridges, and into the trans-
rocesses of the two superior cervical vertebræ. *Use;* draws
d and neck backwards.

*o-lumbalis* and *longissimus dorsi.*—These two muscles arise
non (Fig. 63.) *Origin*, from the spinous and transverse pro-
of the loins and sacrum, and from the crest of the ilium.
st[2] is on the outer side. *Insertion*, into the angles of the rib.
ter[3] is nearest the spine. *Insertion*, into all the transverse
es of the back except the first, and into all the ribs beyond
bercles, except the last two. *Use;* to keep the spine erect,
w down the ribs.

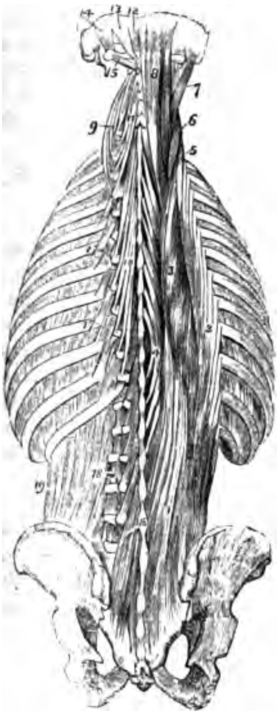
*sorii ad sacro-lumbalem.*—Are muscular slips arising from
at lower ribs and continued into the sacro-lumbalis.

*alis dorsi.*[4]—*Origin*, from the three inferior spinous pro-
f the back, and two superior of the loins. *Insertion*, into
e superior spinous processes of the back, except the first.
o keep the spine erect.

*icalis descendens.*[5]—*Origin*, from the four superior
*m*, into the fourth, fifth, and sixth transverse process
k.

*sversalis cervicis.*[6 9]—*Origin*, from the five superior t verse processes of the back. *Insertion*, into the five middle transverse processes of the neck. *Use;* the two last draw the neck backward.

Fig. 63.



*Trachelo-mastoid.*[7] — *Origin*, from the three superior transverse processes of the back and from the five inferior transverse processes of the neck. *Insertion*, into the mastoid process.

*Complexus.*[8]—*Origin*, from the transverse processes of the four inferior cervical and seven superior dorsal, and from the spinous process of the first dorsal vertebra. *Insertion*, into the occiput between its semicircular ridges. *Use;* the two last draw the head backward.

*Semi-spinalis cervicis.*[11] — *Origin*, from the six superior transverse processes of the back. *Insertion*, into the spinous processes of the five middle cervical vertebræ.

*Semi-spinalis dorsi.*[10]—*Origin*, from the transverse processes of the seventh, eighth, ninth, and tenth dorsal vertebræ. *Insertion*, into the spinous processes of the two lower cervical, and five upper dorsal vertebræ.

*Multifidus spinæ.*[16] — *Origin*, from the posterior surface of the sacrum, and the back part of the ilium, and from the oblique and transverse processes of all the vertebræ of the loins and back, and of the four inferior of the neck. *Insertion*, into the spinous processes of all the vertebræ of the loins and back, and of the five inferior of the neck. *Use;* the three last twist the spine when acting without their fellows.

*Rectus capitis posticus major.*—*Origin*, from the spinous process of the dentata. *Insertion*, into the occiput at its superior semicircular ridge, and below it. *Use;* it turns the head.

*Rectus capitis posticus minor.*—*Origin*, from the tubercle of the atlas. *Insertion*, into the occiput, at the inferior semicircular ridge, and below it.

*Obliquus superior.*—*Origin*, from the transverse process of the atlas. *Insertion*, into the outer end of the inferior semicircular ridge of the occiput.

*Obliquus inferior.*—*Origin*, from the spinous process of the dentata. *Insertion*, into the transverse process of the atlas.

*spinales.*—Between the spinous processes of all the vertebræ. neck, they are double: in the back, tendinous; in the loins, nd well-marked.

*-transversarii.*[16]—Between all the transverse processes. In k, double; in the back, tendinous; in the loins fleshy and *Use.* To approximate these processes.

*tores costarum.*[17]—*Origin*, from the transverse processes of cervical and eleven upper dorsal vertebræ. *Insertion*, into er edge of the rib below, and sometimes into the second rib *Use.* To elevate the ribs.

## MUSCLES OF THE SHOULDER AND ARM.

### FASCIA.

brachial fascia covers the muscles of the upper extremity, cing at the spine of the scapula and clavicle. Upon the it is thin. At the elbow it sends several processes to the hich serve for the origin of muscles, and in front it receives n of tendon from the biceps muscle, which renders it tense. e wrist it forms the anterior and posterior annular ligawhich bind down the tendons of the hand, and in the hand the palmar aponeurosis.

*id.*[5]—*Origin*, from the spine of the scapula, its acromion , and the external third of the clavicle. *Insertion*, into a lar roughness near the middle of the outer side of the hume-*se.* It raises the humerus. (Fig. 62.)

*a-spinatus.*[17]—*Origin*, from the whole of the fossa supra- *Insertion*, into the inner facet of the greater tuberosity of nerus. *Use.* It raises the arm and turns it outwards.

*-spinatus.*[18]—*Origin*, from the whole of the fossa infra- *Insertion*, into the middle facet of the greater tuberosity humerus. *Use.* It rotates the humerus outwards and back-

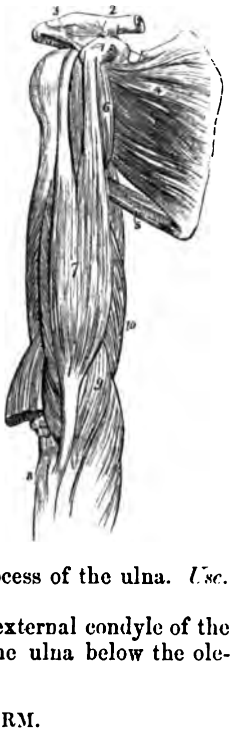
*minor.*[19]—*Origin*, from the lesser costa of the scapula. *n*, into the outer facet of the greater tuberosity of the hume-*se.* It rotates the humerus outwards, and draws it downnd backwards.

*major.*[20]—*Origin*, from the posterior surface of the inferior f the scapula, and a part of its lesser costa. *Insertion*, into terior edge of the bicipital groove of the humerus in common e tendon of the latissimus dorsi. *Use.* It rotates the humeards and draws it downwards and backwards.

*capularis.*[4] (Fig. 64.) *Origin*, from the whole of the capula. *Insertion*, into the lesser tuberosity of the hu rotates the humerus inwards, and draws it downward

*s flexor cubiti.*[7]—*Origin*, from the superior extremit glenoid cavity, by a long tendon which passes through the joint and bicipital groove, and by a short head from the coracoid process of the scapula. *Insertion*, into the posterior and inferior parts of the tubercle of the radius, and into the brachial fascia. *Use.* It flexes the fore-arm.

Fig. 64.



*Coraco-brachialis.*[8] — *Origin*, from the middle facet of the coracoid process of the scapula, in common with the short head of the biceps. *Insertion*, into the middle of the os humeri by a rough ridge on its internal side. *Use.* It draws the arm upwards and inwards.

*Brachialis Internus.*[9]—*Origin*, from the anterior and lower half of the os humeri. *Insertion*, in front of the base of the coronoid process of the ulna. *Use.* It flexes the fore-arm.

*Triceps extensor cubiti.*[10] — *Origin*, by three heads; the first or longus, is from the inferior part of the glenoid cavity. The second or external, is from a ridge from the back part of the os humeri, just below its head; and the third or brevis, is from the inner side of the os humeri, near the bicipital groove. *Insertion*, into the olecranon process of the ulna. *Use.* It extends the fore-arm.

*Anconeus.*[11] (Fig. 67.)—*Origin*, from the external condyle of the humerus. *Insertion*, into the outer side of the ulna below the olecranon. *Use.* It extends the fore-arm.

## MUSCLES OF THE FORE-ARM.

These are eighteen in number, eight of which are on the front of the arm, and are flexors; for the most part they arise from the internal condyle. The remaining ten are extensors, and arise for the most part from the external condyle.

*Pronator radii teres.*[4] (Fig. 65.)—*Origin*, from the internal condyle of the humerus, and the coronoid process of the ulna. *Insertion*, into the middle and external side of the radius. *Use.* It rotates the hand inwards.

*Flexor carpi radialis.*[5]—*Origin*, from the internal condyle of the humerus, the brachial fascia, and the inter-muscular septa. *Insertion*, into the base of the metacarpal bone of the index finger. *Use*; it flexes the hand at the wrist. (Fig. 65.)

*Palmaris longus.*[6]—Is sometimes deficient. *Origin*, from the

. condyle. *Insertion*, into the annular ligament and palmar
:osis. *Use ;* it bends the hand.

Fig. 65.

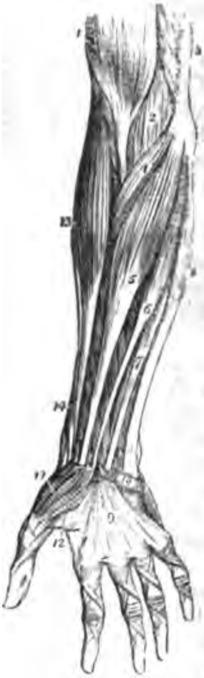
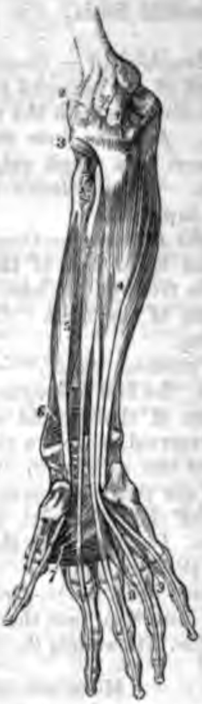


Fig. 66.



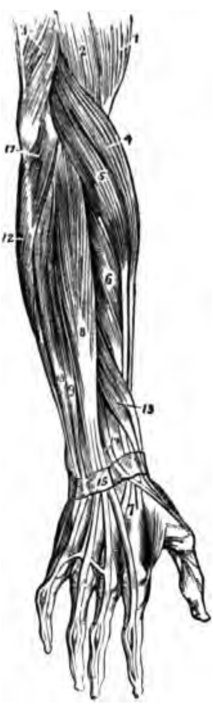
or *carpi ulnaris.*[8]—*Origin*, from the internal condyle, from
ge at the inner side of the ulna and from the olecranon. *In-*
into the pisiform bone and into the base of the metacarpal
' the little finger. *Use;* it flexes the hand.

or *sublimis digitorum perforatus.*[7]—*Origin*, from the in-
:ondyle of the humerus, the coronoid process of the ulna, and
ercle of the radius. *Insertion*, by four split tendons into the
phalanges of the fingers. *Use;* it bends the hand and

or *profundus digitorum perforans.*[4] (Fig. 66.)—*Origi*
a by its anterior flat surface, from its coronoid proc
e interosseous ligament. *Insertion*, by four tendons,
through the perforations in the tendons of the flex
re inserted into the third phalanges of the fingers.

*Flexor longus pollicis.*[5]—*Origin,* from the internal condyle of the humerus, and the middle two-thirds of the radius, and a part of the interosseous ligament. *Insertion,* into the base of the second phalanx of the thumb. (Fig. 66.)

Fig. 67.



*Pronator quadratus.*[6]—*Origin,* from the inner border and anterior surface of the ulna, near its lower extremity. *Insertion,* into the corresponding surface of the radius. *Use;* it rotates the radius inwards.

*Supinator radii longus.*[4] (Fig. 67.)—*Origin,* from the ridge leading to the external condyle of the humerus. *Insertion,* into the radius just above its styloid process. *Use;* it rotates the radius outwards.

*Extensor carpi radialis longior.*[5]—(Fig. 67.) *Origin,* from the ridge of the external condyle of the humerus. *Insertion,* into the posterior part of the base of the *metacarpal* bone of the forefinger.

*Extensor carpi radialis brevior.*[6]—*Origin,* from the external condyle of the humerus, and from the external lateral ligament. *Insertion,* into the posterior part of the base of the metacarpal bone of the middle finger.

*Extensor carpi ulnaris.*[10]—*Origin,* from the external condyle and the brachial fascia. *Insertion,* into the base of the metacarpal bone of the little finger. *Use;* the last three extend the hand.

*Extensor digitorum communis.*[8]—*Origin,* from the external condyle. *Insertion,* by four tendons which are connected by slips previous to their insertion into all the phalanges of the fingers. *Use;* it extends the joints of the fingers.

*Supinator radii brevis.*—*Origin,* from the external condyle, and from a ridge of the ulna on its posterior surface. *Insertion,* into the radius between its tubercle and the insertion of the pronator. *Use;* it rotates the radius outwards.

*Extensor ossis metacarpi pollicis manus.*—*Origin,* from the posterior surface of the ulna, from the interosseous ligament, and a part of the radius. *Insertion,* into the base of the metacarpal bone of the thumb, and into the trapezium.

*Extensor minor pollicis manus.*[13]—*Origin,* from the back of the ulna below its middle, and from the interosseous ligament. *Insertion,* into the first phalanx of the thumb.

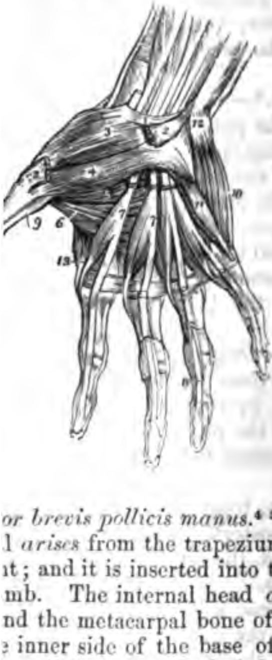
*nsor major pollicis manus.*[14]—*Origin*, from the back of the ›ove its middle, from the interosseous ligament, and from the ' the radius. *Insertion*, into the base of the second phalanx :humb. *Use;* these last three extend the thumb.

*:ator.*—*Origin*, from the back of the ulna, and interosseous ıt. *Insertion*, into the base of the first phalanx of the index *Use;* it extends the fore-finger.

## MUSCLES OF THE HAND.

*naris brevis.*—*Origin*, from the anterior ligament of the wrist, lmar aponeurosis. *Insertion*, into the skin at the inner edge hand. *Use;* it contracts the skin.

Fig. 68.



*Lumbricales.*[7]—These are four in number and resemble earth-worms. *Origin*, from the the tendons of the flexor profundus. *Insertion*, into the radial side of the base of the first phalanx of each finger. *Use;* they assist in bending the fingers. (Fig. 68.)

*Abductor pollicis manus.*[2]—*Origin*, from the annular ligament, trapezium, and scaphoid bones. *Insertion*, into the base of the first phalanx of the thumb. *Use;* it draws the thumb from the fingers.

*Opponens pollicis.*[5]—*Origin*, from the trapezium and annular ligament. *Insertion*, into the radial edge of the metacarpal bone, from its base to its head. *Use;* it draws the metacarpal bone inwards.

*or brevis pollicis manus.*[4] [5]—It consists of two bellies. The l *arises* from the trapezium and trapezoides, and the annular ıt; and it is inserted into the outer side of the first phalanx of mb. The internal head *arises* from the magnum and unciand the metacarpal bone of the little finger; and it is inserted : inner side of the base of the first phalanx of the ıamoid bones are included in these tendons.

*uctor pollicis manus.*[6]—*Origin*, from the metacarpal b· ldle finger between its base and its head. *Insertion*, i the first phalanx of the thumb. *Use;* it draws the ı the fingers.

*ıctor minimi digiti manus.*[10]—*Origin*, from the pisı bone, and annular ligament. *Insertion*, into the ulnar side of the base of the first phalanx of the little finger. *Use;* it draws the little finger from the rest.

*Flexor parvus minimi digiti.*[11]—*Origin*, from the unciform process of the unciform bone, and annular ligament. *Insertion* into the ulnar side of the base of the first phalanx of the little finger. *Use;* it bends the little finger.

*Adductor metacarpi minimi digiti.*—*Origin*, from the unciform process and annular ligament. *Insertion*, into the metacarpal bone of the little finger, from its base to its head. *Use;* it brings the metacarpal bone towards the wrist.

*Interosseous muscles.*—These are seven in number; three of which are on the *palmar* side, and four on the *dorsal* side. The palmar interossei are *adductors*, the dorsal are *abductors* with reference to the median line of the hand.

Fig. 69.

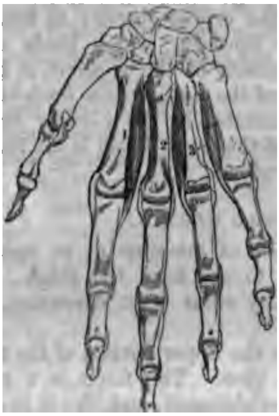
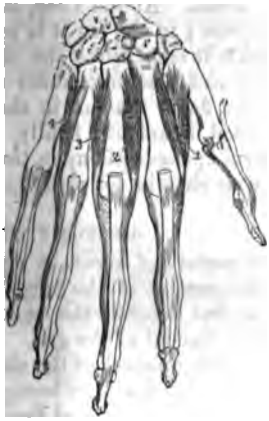


Fig. 70.



The *palmar interosseous muscles.* (Fig. 69.)—These arise from the base of the metacarpal bone of one finger, and are inserted into the base of the first phalanx of the same finger. The first belongs to the index finger,[1] the second to the ring finger,[2] and the third to the little finger.[3]

The *dorsal interosseous* are penniform, arising by two heads from adjoining sides of the metacarpal bones. (Fig. 70.) They are inserted into the bases of the first phalanges; the first into the index finger,[1] the second and third into the middle finger,[2][3] compensating its exclusion from the palmar group; the fourth into the ring finger.[4]

The diversified and confused description of these muscles by different authors, is owing to the use of terms that are not significant, a want of proper classification, and the dividing of one muscle in

d calling the different portions of it by different names; thus,
umerate four *palmar* and three *dorsal* interossei, together
e muscle called *abductor indicis;* others, again, enumerate
lmar and four dorsal. The principle of classification should
regard to their *action.* Whether they are abductors or
rs, with reference to an axis passing through the middle fin-
f the first dorsal interosseous is split into two muscles, and
rtion arising from the metacarpal bone of the thumb, is called
*luctor indicis,* and the remaining portion counted among the
interossei, the various modes of classifying these muscles,
ily be understood.

## MUSCLES OF THE LOWER EXTREMITY.

lower extremity is covered by a dense fascia called *fascia*
hich commences at the crest of the ilium, and extending over
tei muscles, reaches to the foot. In the front of the thigh
rmed *iliac* and *pubic,* with reference to its proximity to
ones. At the knee, it forms a general covering, called the
*rum;* in the leg it is termed the *crural fascia;* in front of
le it constitutes the *annular ligament,* which binds down
ensor tendons; under the sinuosity of the os calcis, it binds
he flexor tendons in the form of the *ligamentum laciniatum,*
ted ligament; finally, it terminates in the *plantar fascia,*
m aponeurosis upon the sole of the foot. From it are formed
us sheaths for muscles and tendons.

## ANATOMY OF FEMORAL HERNIA.

variety of hernia is a protrusion of intestine at an opening
e passage of the large vessels to and from the thigh. We
first describe the parts as they occur upon dissection, and
e descent of the gut.

the removal of the skin from the upper portion of the thigh
*erficial fascia* is brought into view. This fascia is a conti-
of the superficial fascia of the abdomen, and like it is capa-
eing dissected in laminæ. In the groin it contains numerous
tic glands. It is traversed by the *saphena vein,* which enters
oral vein, through the *saphenous opening* of the fascia lata,
n inch below Poupart's ligament.

ng removed this fascia we bring into view the *fascia lata* of
gh. This fascia is of a pearly white colour and very dense
re. It consists of two portions, the sartorial and pectineal.
*torial* portion[1] is upon the iliac side, and is connected at its
art with Poupart's ligament. It passes in front of the sheath
essels, and has a crescentic edge on its inner side, calle
*m* process. This process limits the saphenous openin
r side; and in order that this edge should be distinctly s
of superficial fascia with which it is continuous must

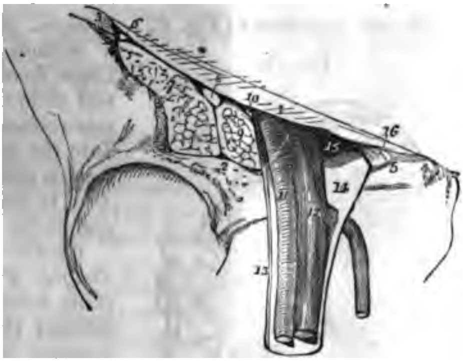
carefully removed; this portion of superficial fascia which fills up the saphenous opening is often called *cribriform fascia*. (See Fig. 60.)

The superior horn of this crescentic falciform process is twisted and inserted in the crest of the pubes, external to, but continuous with, Gimbernat's ligament, and is called *Hey's* ligament.

The *pectineal* portion of the fascia lata is upon the pubic side; it is thinner than the sartorial and passes behind the sheath of the vessels.

The sheath of the vessels is formed of condensed cellular tissue, and may be considered a prolongation of the fascia transversalis and fascia iliaca. It is usually compared to the tubular portion of a funnel; the abdominal portions of these fasciæ constituting the larger and upper part of the funnel. Numerous perforations exist in the sheath of the vessels for the passage of veins and absorbents, which renders it cribriform. One of these perforations can be seen where the sheath is laid open, and also the saphena vein entering the femoral vein.[23] Since the artery[11] and vein[12] are cylinders, it must be evident that there must be some structure filling up the intervening spaces, and also the space[15] between the vein and Gimbernat's ligament,[16] or else there would be a deficiency of structure. Now this space is the *crural ring*,[15] and is filled up with loose cellular tissue and a lymphatic gland. This cellular tissue is called by some the *crural septum*, by others *fascia propria* and *cribriform fascia*. A weakness of this septum between the cavity and tube of the funnel predisposes to hernia. The crural or femoral ring is *bounded* in front by Poupart's ligament; behind, by the bone; on the inside by Hey's and Gimbernat's ligament; on the outside by the vein. The femoral vessels,[11] [12] with their sheath,[13] together with the iliacus internus[7] and psoas magnus[9] muscle, pass out under Poupart's ligament, and thus fill the crural arch.

Fig. 71.



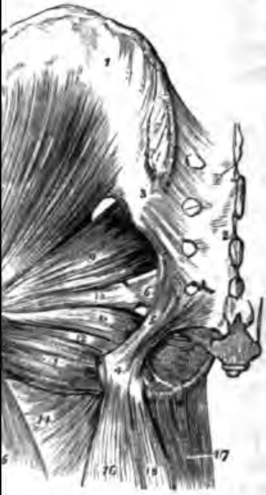
The intestine in femoral hernia pursues the following course. The peritoneum, as in all other instances, is at first distended and forms the hernial sac; this distension takes place at the crural ring, eing the only spot where it can occur under the crural arch; *ural septum* or fascia propria is now stretched and thickened; illy yielding, it forms the next covering of the gut. With it descends the sheath of the vessels, and when it gets below lciform process, emerges at one of the foramina for veins or ents; then it comes in contact with the superficial fascia, forms another covering, and the skin forms the last.

eaching the intestine by an operation for hernia, the order of ngs would be first, the *skin*, second, the *superficial fascia*, ing that portion of it which some call *cribriform fascia*, third, *scia propria*, which was originally the crural septum, which call cribriform fascia, and fourth, the *hernial sac*, containing otruding intestine. Much alteration of structure would of course by the parts becoming thicker and more laminated. In some ins the foramen of the sheath is not sufficiently large, and then eath is distended and consolidated with the other coverings. restrict the term *fascia propria* to this consolidated covering. emoral hernia may be concealed either above or below the nous opening; then of course the fascia lata will also form one coverings. (See SURGERY.)

## MUSCLES OF THE HIP AND THIGH.

*teus maximus.*[9] (Fig. 62)—*Origin.* From the crest and from a portion of the dorsum of the ilium, from the sides of the sacrum and coccyx, and from the greater sacro-sciatic ligament. *Insertion.* Into the upper third of the linea aspera, and into the fascia femoris. *Use.* It draws the thigh backwards and keeps the trunk erect.

Fig. 72.



*Gluteus medius.*[8] (Fig. 62.)—*Origin.* From the dorsum of the ilium between the crest and semicircular ridge, from between the anterior spinous processes, and from the fascia femoris. *Insertion.* Into the upper and outer surface of the trochanter major. *Use;* it draws the thigh backwards and outwards.

*Gluteus minimus.*[6] (Fig. 72.)—*Origin.* From the dorsum of the ilium, between the semicircular ridge and the capsular ligament.

*Insertion.* Into the trochanter major in front and below that of the medius. *Use.* It abducts and rotates the thigh inwards.

*Pyriformis.*[9]—*Origin.* From the second, third, and fourth bones of the sacrum. *Insertion.* Into top of the trochanter major. *Use.* It rotates the limb outwards.

*Gemini.*[10] [11]—These are two in number; the superior arises from the spinous process of the ischium, and the inferior from the tuberosity of the ischium; both are inserted in common with the tendon of the obturator internus.

*Obturator internus.*[11]—*Origin.* From the margin of the thyroid foramen, the internal surface of the thyroid ligament, and from the fascia iliaca. *Insertion.* Into the digital fossa of the femur.

*Quadratus femoris.*[12]—*Origin.* From the tuberosity of the ischium. *Insertion.* Into the femur between the two trochanters.

*Obturator externus.*—*Origin.* From the anterior margin of the thyroid foramen, and ligament. *Insertion.* Into the digital fossa at the root of the trochanter major. *Use.* The last four rotate the thigh outwards.

*Biceps flexor cruris.*[13]—*Origin.* By a long head in common with the semi-tendinosus from the tuberosity of the ischium, and by a short fleshy one from the lower part of the linea aspera. *Insertion.* Into the head of the fibula.

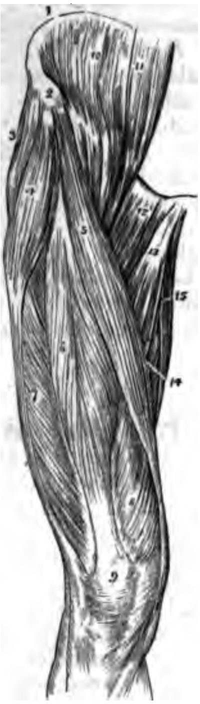
*Semi-tendinosus.*[13]—*Origin.* From the tuberosity of the ischium. *Insertion.* Into the side of the head of the tibia just below its tubercle.

*Semi-membranosus.*—*Origin.* From the external part of the tuberosity of the ischium. *Insertion.* Into a groove at the posterior and internal side of the head of the tibia, and it is also connected with the ligament of Winslow and the external condyle of the femur.

*Tensor vaginæ femoris.*[4]—(Fig. 78.) *Origin.* From the anterior superior spinous process of the ilium. *Insertion.* Into the fascia or sheath of the thigh.

*Sartorius.*[5]—*Origin.* From the anterior superior spinous process of the ilium. *Insertion.* Into the inner side of the head of the tibia. *Use.* It bends the leg and draws it inwards. It is the longest muscle of the body.

Fig. 78.



*Rectus femoris.*[6]—*Origin.* By two tendons, one from the anterior inferior spinous process of the ilium, and the other from the edge acetabulum. *Insertion.* Into the upper surface of the

*us externus.*[7]—*Origin.* From the linea aspera, and trochanter
*Insertion.* Into the upper and external part of the patella.
*us internus.*[8]—*Origin.* From the linea aspera in its whole
covering the inside of the thigh. *Insertion.* Into the com-
idon of the patella.
*eus.*—*Origin.* From the anterior part of the femur as well
the linea aspera. *Insertion.* Into the patella.
four last muscles, often called the *quadriceps femoris*, form
on tendon in which is placed the patella, before it is in-
nto the tubercle of the tibia. It extends the leg.
*ilis.*[15]—*Origin.* From the body and ramus of the pubes.
*n.* Into the inside of the head of the tibia.
*neus.*[12]—*Origin.* From the crest of the pubes, and the trian-
ce in front of it. *Insertion.* Into the linea aspera below the
ter minor.
*ctor longus.*[13]—*Origin.* From the body of the pubes. *Inser-*
ito the middle third of the linea aspera.
*ctor brevis.*—*Origin.* From the body and ramus of the pubes.
*n.* Into the upper third of the linea aspera.
*ctor magnus.*[14]—*Origin.* From the body and ramus of the
and from the ramus of the ischium. *Insertion.* Into the
ngth of the linea aspera. At the junction of the middle and
hirds of its insertion it is perforated by the femoral artery.
iese four last draw the thigh forwards and inwards.

## MUSCLES OF THE LEG.

*lis anticus*[3] (Fig. 74.)—*Origin*, from the outer side and
the tibia and from the interosseous ligament. *Insertion*,
base of the internal cuneiform bone, and base of the first
sal bone.
*nsor Longus Digitorum Pedis.*—*Origin*, from the head of
la, the head of the tibia, and from a portion of the inter-
ligament, and edge of the fibula. *Insertion*, by four
into the phalanges of the four lesser toes.
*neus Tertius.*[6]—*Origin*, from the anterior angle of the fibula,
ts middle. *Insertion*, into the upper surface of the base of
atarsal bone of the little toe. It looks like a portion of the
ned muscle.
*nsor Proprius Pollicis Pedis.*[5]—*Origin*, from the lower two-
f the fibula and interosseous ligament. *Insertion*, i
the first and second phalanges of the great toe.
the great toe.
*eous Longus.*[7]—*Origin*, from the head and upper

the outer side of the fibula. *Insertion*, into the base of the metatarsal bone of the great toe. *Use*; it extends the foot and inclines the sole outwards.

Fig. 74.

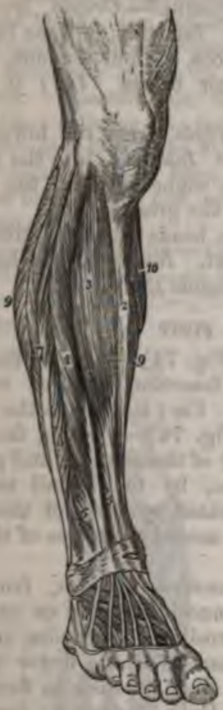
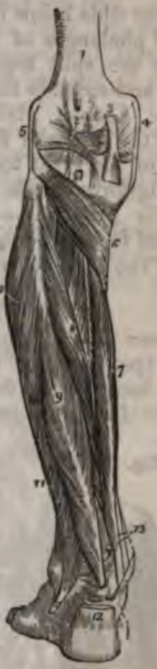


Fig. 75.



*Peroneus Brevis.*[8] — *Origin*, from the lower two-thirds of the outer surface of the fibula. *Insertion*, into the base of the metatarsal bone of the little toe. *Use*; it extends the foot.

*Gastrocnemius.*—*Origin*, by two heads from the condyles of the femur. *Insertion*, by the *tendo Achillis* into the tuberosity of the os calcis.

*Soleus.*—*Origin*, from the upper two thirds of the posterior part of the fibula, and the middle third of the tibia. *Insertion*, into the *tendo Achillis*.

These last two muscles form the calf of the leg, and are called the triceps suræ.

*Plantaris.*—This muscle has the longest tendon in the body.

just above the external condyle of the femur. *Insertion,*
e os calcis before the *tendo Achillis.*

*iteus*[6] (Fig. 75).—*Origin,* from behind the external condyle
emur. *Insertion,* into an oblique ridge of the tibia, below its
*Use;* it bends the leg and rolls it inwards.

*or Longus Digitorum Pedis Perforans.*[7]—*Origin,* from the
the tibia below its oblique ridge. *Insertion,* into the bases of
rd phalanges of the four lesser toes, by four tendons, which
te the split tendons of the flexor brevis. *Use;* it flexes
s and extends the leg.

*or Longus Pollicis Pedis.*[8]—*Origin,* from the lower two-
f the posterior face of the fibula. *Insertion,* into the second
of the great toe. Its tendon is connected with the flexor
digitorum pedis. *Use;* it flexes the great toe.

*alis Posticus.*[9]—*Origin,* by two heads from the tibia and
and from the interosseous ligament. *Insertion,* into the tube-
f the caphoid bone. *Use;* it extends the foot.

## MUSCLES OF THE FOOT.

*nsor Brevis Digitorum Pedis*[11] (Fig. 74).—*Origin,* from the
apophysis of the os calcis. *Insertion,* by four tendons
e backs of the four greater toes. *Use;* it extends the toes.

*or Brevis Digitorum Pedis*[5] (Fig. 76).—*Origin,* from the larger tuberosity of the os calcis and plantar fascia. *Insertion,* by four small tendons, which are perforated by those of the flexor longus, into the second phalanges of the four smaller toes.

Fig. 76.

*Flexor Accessorius.*—*Origin,* from the inside of the sinuosity of the os calcis in front of its tuberosities. *Insertion,* into the outside of the tendon of the flexor longus, at its division. *Use;* it assists in flexion.

*Lumbricales Pedis.*[7]—*Origin,* from the tendons of the flexor longus. *Insertion,* into the inside of the first phalanx of each toe. *Use;* they assist in flexion.

*Abductor Pollicis Pedis.*[3]—*Origin,* from the internal tuberosity of the os calcis, the plantar fascia, and internal cuneiform bone. *Insertion,* into the inner side of the
of the first phalanx of the great to
cluding the internal sesamoid bone.
it draws this toe from the others.

*Flexor Brevis Pollicis Pedis.*—It co
of two bellies, which *arise* from the
neo-cuboid ligament and external cune

bone. *Insertion*, by two tendons into the base of the first phalanx of the great toe, including the sesamoid bones. *Use*; it flexes this toe.

*Adductor Pollicis Pedis.*—*Origin*, from the calcaneo-cuboid ligament, from the bases of the third and fourth and fifth metatarsal bones. *Insertion*, into the tendon of the flexor brevis and external sesamoid bone. *Use*; to draw this toe towards the rest.

*Abductor Minimi Digiti Pedis.*[*]—*Origin*, from the outer and lesser tuberosity of the os calcis and the metatarsal bone of the little toe. *Insertion*, into the base of the first phalanx of the little toe. *Use*; it draws this toe from the others.

*Flexor Brevis Minimi Digiti Pedis.*—*Origin*, from the calcaneo-cuboid ligament, and from the fifth metatarsal bone. *Insertion*, into the base of the first phalanx of the little toe. *Use*; it bends the little toe.

*Transversalis Pedis.*—*Origin*, from the capsular ligaments of the first joint of the fourth and fifth toes. *Insertion*, into the external sesamoid bone. *Use*; it approximates the heads of the metatarsal bones.

Fig. 77.

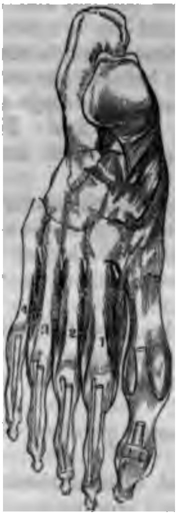
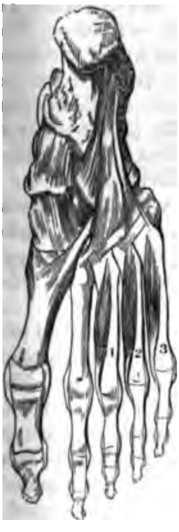


Fig. 78.



*Interosseous Muscles.*—These are seven in number, four of which are upon the dorsal, and three upon the plantar surface of the foot. The *dorsal interossei*, arise by double heads, and are inserted into

es of the phalanges. The first is inserted on the inner side
econd toe, and is therefore an adductor; the other three are
l into the outer side of the second, third and fourth toes, and
uctors. The *plantar interossei* arise from the bases of the
uter metatarsal bones, and are inserted into the inner side
ases of the first phalanges of the same toes. In their action
e adductors.

# SECTION IV.

## VISCERA.

### ORGANS OF DIGESTION.

### MOUTH.

*Mouth* is separated from the nose by the hard and soft palate,
nmunicates behind with the fauces. It is bounded in front
lips, while its floor is formed by the mylo-hyoid muscles, and
s by the cheeks. The space between the lips and the teeth
d the *vestibule*. The mouth is lined by a mucous mem-
which has a variable degree of thickness, and is thrown into
hich are called *frena*; there is one beneath the tongue, one
of the epiglottis cartilage at the root of the tongue, and one
niddle of the inner surface of each of the lips. This mem-
covered with numerous glands, some of which are mucous
ne salivary.

nally the lips are composed of fibres,—which extend from the
of the internal surface of each lip to the gum,—and fat, ex-
of skin. The *upper lip* is longer and thicker than the
and has a vertical depression on the middle of its front sur-
led *philtrum*.

*Gums* are formed of the lining membrane of the mouth, much
ed; they have great hardness and vascularity, and but little
ity in health. They include the neck of the tooth, and
firmly to the periosteum.

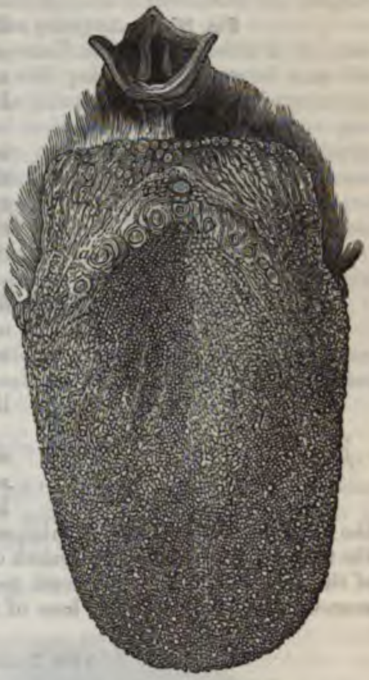
gums and lips are covered by numerous papillæ, which con-
apillaries and nerves.

cheeks are composed of muscle, fat, cellular tissue, glands,
od-vessels, included between skin and mucous membrane.

### TONGUE.

*Tongue* is an oblong, flattened, muscular body, which v

Fig. 79.



in size and shape; it is the organ of taste, and also of importance in speech and mastication. Its posterior extremity or root is attached to the hyoid bone by yellow fibrous tissue. Its anterior extremity is called its point or *tip*; its intervening portion its *body*.

The *mucous covering* of the tongue is very thick upon its upper surface, and very thin upon its under surface. Sometimes the term periglottis is applied to the epithelium of the upper surface. Upon its upper surface are a number of projections or *papillæ* of various sizes and shapes. The largest are eight or nine in number, called papillæ *maximæ*, and are situated at the posterior portion of the tongue, in two convergent lines; they are surrounded by fossæ, the largest of which is in the middle, and called the *foramen cæcum*. These larger papillæ will be found to be covered by smaller ones, which are called secondary papillæ. The smallest papillæ are fine and pointed, and are found near the middle of the tongue, and are termed *filiform*. The intermediate papillæ are most abundant, some of them are *conical*, others *fungiform*. Each papilla is formed of capillary vessels and a nerve. Different functions are attributed to these different papillæ.

Between the papillæ maximæ and the epiglottis are a number of large mucous follicles.

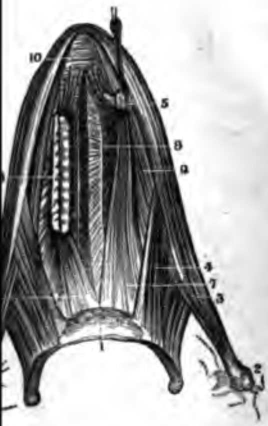
*Muscles of the Tongue.*—*Hyo-glossus.*[4]—*Origin*, from the cornu of the hyoid bone. *Insertion*, into the side of the tongue, some of the fibres reaching its tip.

*Genio-hyo-glossus.*[5]—*Origin*, by a tubercle behind the symphysis of the lower jaw. *Insertion*, into the hyoid bone, and into the whole length of the tongue.

*Lingualis.*[9]—*Origin*, from the yellow tissue at the root of the

. *Insertion*, into the tip between the two last-mentioned s.

Fig. 80.



*Superficialis linguæ.*—An indistinct layer of muscular fibres on the dorsum of the tongue under the mucous membrane. It seems to curl the lip upwards.

*Transversales linguæ.*[10]—Are scattered fibres which pass from the middle line to the edge of the tongue; they extend from the tip to the root, and their contractions lengthen the tongue.

*Verticales linguæ.*—These are fibres which extend from the upper to the lower surface of the tongue.

The tongue is supplied by the lingual artery.

The nerves are the *hypoglossal* or 9th, which is distributed to its muscles; the lingual or *gustatory* branch of the 5th, which supplies ıpillæ and mucous membrane at the forepart and sides of ıgue; and the lingual branch of the glosso-pharyngeal division 8th, which sends filaments to the papillæ maximæ, and to the s membrane near the base of the tongue.

## THE PALATE.

palate separates the back portion of the nose from the mouth, divided into two parts. The *hard palate* consists of the processes of the superior maxillary and palate bones, covered cous membrane, which is continuous with that of the mouth, not so vascular or sensitive as that of other parts. It very ntly presents transverse ridges, as well as a ridge in the meine. The *soft palate* is the membranous separation between ck portion of the mouth and nose, and consists of a fold of s membrane stretched transversely, enclosing muscles and . From its middle there projects the *uvula*, about three rs of an inch in length; from each side of the uvula there are vergent crescentic folds of mucous membrane, which are called *half-arches*; the space between which constitutes the *fauces*. ween the anterior and posterior arches of each side is the *gland*. The *tonsil* is about the size of an almond, and consists llection of large mucous follicles.

*Muscles of the palate.*—*Constrictor isthmi faucium.*—A small muscle placed in each anterior half-arch, *arising* from the middle of the soft palate, and *inserted* into the side of the root of the tongue. It diminishes the opening into the pharynx.

*Palato-pharyngeus.*—Another small muscle, included in the posterior half-arch, arising from the soft palate, and *inserted* into the side of the pharynx. It draws the palate down and the pharynx up.

*Circumflexus* or *Tensor palati.*—*Origin*, from the spinous process of the sphenoid bone, and the contiguous portion of the Eustachian tube. *Insertion*, by a tendon, which winds around the hamulus or hook of the internal pterygoid process, into the posterior and crescentic edge of the palate. *Use*; to extend the soft palate transversely.

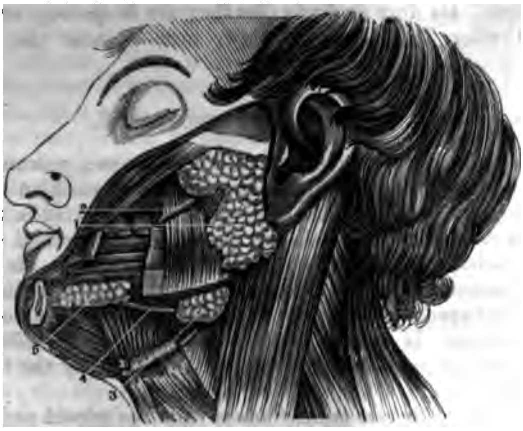
*Levator palati.*—*Origin*, from the petrous portion of temporal bone and Eustachian tube. *Insertion*, into the soft palate. *Use*; it draws the palate upwards.

*Azygos uvulæ.*—Is in the middle of the uvula and soft palate. It arises from the posterior nasal spine. Its contractions shorten the uvula.

### SALIVARY GLANDS OF THE MOUTH.

The salivary glands are of a light pink colour, and their secretion is of great service in mastication and digestion. They are three in number—the parotid, submaxillary, and sublingual.

Fig. 81.



The *parotid* is the largest of the three: its shape is irregular; it has no capsule, and is merely covered by the superficial fascia of the

[t lies on the side of the face in front of the ear, and beneath
ı. It extends in front, so as to cover a portion of the masıuscle; in depth in reaches towards the styloid process, and
ırly it is bounded by the external meatus, the mastoid process,
ɜ sterno-cleido-mastoid muscle. Its structure is lobulated,
duct, called the *duct of Steno*,[2] traverses the outer face of
sseter muscle in a line drawn from the lobe of the ear to the
the nose. It is white and hard, about the size of a crownd perforates the cheek through a pad of fat by a very small
ɔpposite the second molar tooth of the upper jaw. The ex-
ɔarotid artery passes through the deeper portion of the gland,
s also traversed by the portio dura nerve. There is sometimes
n front of the gland an accessory portion, called *socius*, or
*ius parotidis*, whose duct empties into that of Steno.

*submaxillary* gland[3] is much smaller than the parotid, is
.rly oblong in figure and lobulated in structure. It is situated
ɔression on the internal face of the inferior maxillary bone,
ered externally by the skin, superficial fascia, and platysma
Its duct[4] is called the *duct of Wharton*, which empties at
: of the frænum under the tongue by a very small orifice on
ımit of a papilla; the coats of this duct are very thin; the
ȝ traversed by the facial artery as it mounts the lower jaw.
nes there is an additional gland and duct, called after Bar-

*ublingual gland*[5] is the smallest of the three; its shape is
ong, and its structure lobulated; it is situated under the
between the mucous membrane of the mouth and the mylouscle. Its duct or ducts (for they are frequently numerous)
ed after Rivinus, and empty into or near the duct of
n.

## THE PHARYNX AND ŒSOPHAGUS.

*ɔharynx* is a muscular and membranous sac, communicating
ɜ mouth, nose, œsophagus, larynx, and Eustachian tube. It
ed in front of the vertebral column, and extends from the
ɔrocess of the occiput to the fourth or fifth cervical vertebra.
ınel-shaped, being larger above than it is below. Its length is
re inches, although this varies by contraction and distension;
'er collapsed, for its walls are always kept distended by its
r origins. It consists of three coats, *muscular*, *cellular*, and
Its external or muscular coat is formed by the following

*nferior constrictor muscle*[9] arises from the cricoid and tl
꞉s. (Fig. 82.) The fibres terminate in those of its
e posterior median line; those of the upper part are ol
the lower horizontal.

The *middle constrictor muscle*[10] arises from the cornu of the os hyoides, and the lateral thyreo-hyoid ligament, and is inserted into its fellow in the posterior median line. Its upper fibres ascend obliquely to the basilar process of the occiput, and overlap the superior constrictor, while its lower fibres are horizontal or descending, and are overlapped by the inferior constrictor.

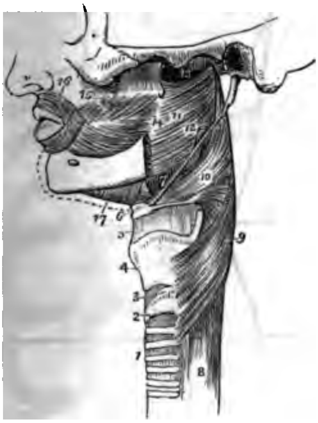
The *superior constrictor muscle* is quadrilateral, and arises from the pterygoid process of the sphenoid bone, from the upper and lower jaw, the buccinator muscles, and the root of the tongue: it is inserted into its fellow behind, and also into the basilar process of the occiput.

The *stylo-pharyngeus muscle*[12] has been described before.

The *cellular* coat is thin, and merely serves for the transmission of vessels and nerves, and the connexion of the external and internal coats.

The *internal or mucous coat* is a continuation of that of the mouth, nose, and Eustachian tube, and it is covered by a thin epithelium, and studded with mucous follicles and glands. It is supplied by the pharyngeal and palatine arteries, and by the sympathetic and eighth pair of nerves. Its uses are for deglutition, respiration, and modulation of the voice.

Fig. 82.



The *œsophagus* is a canal which conveys the food from the pharynx to the stomach. It is situated in the median line, in front of the vertebral column, and passing through the posterior mediastinum inclines somewhat to the left side at its lower part, where it passes through the diaphragm.

Its length is about nine or ten inches, and its diameter is not uniform, gradually increasing as it descends. Its upper portion is the narrowest part of the alimentary canal, and hence foreign bodies which are too large to pass through the alimentary canal, are generally arrested in the neck; its shape is cylindrical, although its walls when at rest are in contact. It never contains air.

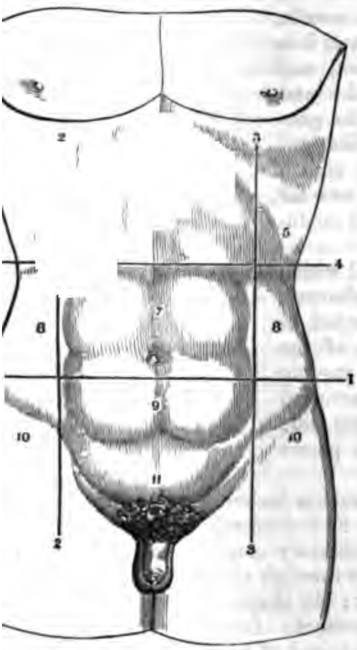
It has three coats, the external of which is muscular, and thicker than any other portion of the canal. The muscular coat consists of two layers; the fibres of the external are longitudinal, and those of the external are circular. The *cellular* coat attaches the muscular and mucous, and serves for the passage of vessels and nerves. The *internal* or *mucous* coat is continuous with that of the pharynx, and umber of longitudinal folds when in a state of quiet. It has epithelium, and numerous mucous glands and follicles. It lied by the œsophageal arteries, proceeding from the inferior , aorta, coronary, and phrenic arteries; its nerves are derived ıe eighth pair, and from the sympathetic.

utition is performed by the contraction of its longitudinal which shorten the passage, and by the contraction of its circbres successively from above downwards.

## VISCERA OF THE ABDOMEN.

cavity of the abdomen is divided into nine different regions, by the drawing of parallel lines vertically[2,3] through the anterior inferior spinous processes, and intersecting them with two other parallel lines drawn transversely[1,4] over the crests of the ilia, and over the most prominent part of the costal cartilages. We thus have three regions above, three in the middle, and three below.

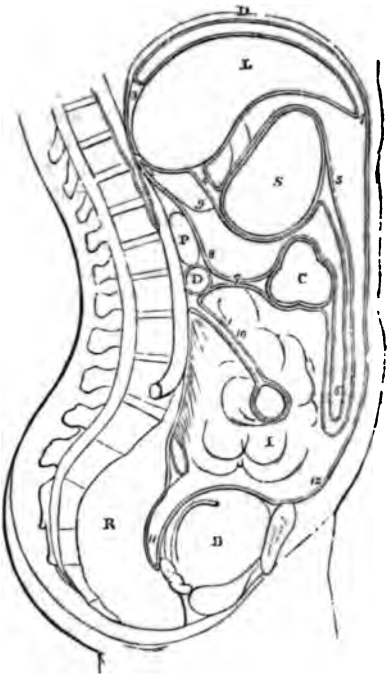
Fig. 83.



They are the *epigastric*,[6] in which are the left lobe of the liver, and a portion of the stomach; the *right hypochondriac*,[5] containing within it the right lobe of the liver, the *left hypochondriac*, containing the spleen, a portion of the stomach, and the liver; the *umbilical*,[7] in which are the small es, and on either side the *lumbar* regions;[8] the *right lu* contains the right kidney, and ascending colon; while tl ɜ the left kidney and descending colon; the *hypo* [11] in which is a portion of the small intestines and bl and the *iliac fossæ*;[10] the *right* of which contains the cœcum or caput coli, and the *left* contains the sigmoid flexure.

## PERITONEUM.

Fig. 84.



The peritoneum is a thin, transparent membrane, lining the cavity of the abdomen, and covering most of the viscera that are contained therein. It is a serous membrane, and therefore a shut sac, following the general rule of lining the cavity, and covering the organs contained within. It secretes a small quantity of fluid in health, which lubricates the surfaces of the viscera, so that they readily move upon each other and the walls of the cavity. It also forms ligaments and connexions whereby the viscera are held in their places. That portion of the peritoneum which passes between one viscus and another, or from a viscus and the wall of the cavity, usually consists of two laminæ, and is called an *omentum*. There are four principal omenta, viz., the *gastro-hepatic*, or *lesser omentum*, which reaches from the lesser curvature of the stomach to the liver; the *gastro-splenic*, reaching from the left extremity of the stomach to the spleen; the *colic-omentum* or *meso-colon*, which holds the large intestine to the posterior wall of the abdomen; and lastly, the *gastro-colic* or *great omentum* or *caul*, which passes between the stomach and colon; the last is the largest, and covers the intestines like an apron; it appears to consist of four layers, whereas, like the rest, it consists but of two. Owing to its great size and the proximity of the colon to the stomach, it must necessarily be folded or doubled, and thus presents a quadruple appearance.

Since the peritoneum is a continuous membrane, its whole surface can be traced in a male subject with the point of a finger, other-would not be a single sac. In the female there is a deficiency xtremity of the Fallopian tube.

nencing at the umbilicus to trace the peritoneum, it will be o line the anterior wall of the abdomen and under surface of phragm, thence to cover the upper and a part of the lower of the liver,[L] thence to pass to the stomach,[8] forming thus[4] er lamina of the gastro-hepatic or lesser omentum; having the anterior face of the stomach,[8 5] it passes down to form he laminæ of the apparently quadruple omentum—the gastro-scending again it forms another lamina, and surrounding rior semi-circumference of the colon,[C] it passes to the verte-lumn, forming the inferior lamina of the colic omentum,[7] find it including the small intestine forming at the mesen- from the vertebral column it can be traced over the upper erior part of the rectum,[R] and over the posterior and superior of the bladder,[B] forming at the vesico-rectal pouch,[11] and e trace it to the umbilicus, the point whence we started.

in thus tracing it will be found, by the diagram, that we t traced the peritoneum covering some portions of the viscera lomen. In the dead subject it is very easy to introduce the hrough a narrow passage which is called the *foramen of* *c*, although there is no hole or tearing of the peritoneum. ing for the posterior end of the gall-bladder and passing the nder the vessels of the liver, it will be easy to touch the peri- covering the posterior surface of the stomach. This cannot onstrated very clearly from a drawing alone, which repre-erely a longitudinal section of the abdominal cavity; and explanation it gives the false idea of there being two sacs of one. In the subject, however, by placing the finger upon er surface of the liver, we trace the peritoneum through the of Winslow; there it forms the inferior lamina of the lesser m,[4] thence it covers the inferior surface of the stomach; ing it forms the third and ascending at [6], it forms the fourth of the great omentum; then it covers the superior convexity olon, and forming the superior lamina of the colic omentum scends in front of the duodenum and pancreas,[P D] and passing he foramen of Winslow, we can trace upon the posterior and portion of the liver, the point of starting.

*mesentery* is formed of two laminæ of peritoneum, and serves ect the small intestine to the parietes of the abdomen. Its about six inches wide, and its inferior edge equals in breadth le length of the small intestine. Between these two laminæ oneum are the superior mesenteric artery and vein, ly nd vessels, and branches of the sympathetic nerve, portion of fat and cellular tissue.

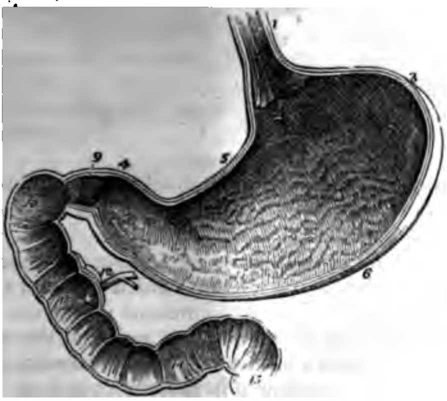
*meso-colon* is also formed of two laminæ of peritone holds the large intestine in its place. The transverse portion is long and loose, but on each side in the iliac regions it is short, and binds the intestine down very tightly; it also contains between its laminæ, vessels and nerves, together with some fat and cellular tissue; that portion which is attached to the rectum is called the *meso-rectum*.

## THE STOMACH.

The stomach is a conoidal sac, somewhat bent or curved, and is situated in the left hypochondriac and epigastric regions. It is somewhat flattened anteriorly and posteriorly, and thus presents an anterior and posterior face; its direction is oblique from above downwards, and from left to right. The left[3] extremity is much the larger, and terminates in a rounded cul-de-sac; at the superior portions of this extremity is the *cardiac* orifice, where the œsophagus is continued into the stomach immediately below the diaphragm. The right extremity gradually diminishes in size, and its orifice is called *pyloric*,[9] which is continuous with the small intestine. The structure of the pylorus is much thicker than that of any other portion.

The stomach is held in its position by the œsophagus and the duodenum, as well as by peritoneal reflexions. The right end is lower and more anterior than the left.

Fig. 85.



The upper and lower curvatures of the stomach are called the greater and lesser curvatures.[5] [6] Near the pyloric extremity of the stomach, is a slight dilatation[7] called *antrum pylori*. The dimensions of the stomach are variable, depending upon the mode of life. It consists of four coats; peritoneal, muscular, cellular, and mucous.

The walls of the stomach consist of four distinct coats.

The *Serous or Peritoneal coat* completely covers the stomach, except at the curvatures, where are attached the omenta; the looseness of the omental connections at these points admits of the distension of the remaining coats.

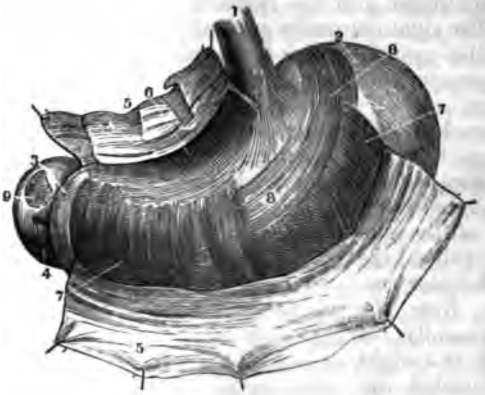
The *Muscular coat* is not so thick as that of the œsophagus, and

›s pass both in a circular,[7] longitudinal,[6] and oblique direc-
ee Fig. 86). The muscular fibres which pass obliquely
the left extremity, constitute the muscle of Gavard. The
: fibres are most numerous near the pyloric orifice, and the
dinal fibres are most distinct upon the lesser curvature.
:ter are the most external, and are a continuation of those of
›phagus.

*Cellular* or *nervous coat* connects the muscular and mucous;
:s for the transmission of vessels and nerves, and can readily
ıted; when dried, it resembles cotton.

*Mucous* or *Villous coat,* is a continuation of that of the œso-
; it is soft and thick, of a light pink colour, and is thrown

Fig. 86.



ıumber of longitudinal *rugæ* or folds, which are particularly
ʼus at the greater curvature, and nearer the pyloric orifice.[8]
ig. 86.)

he pyloric orifice, the mucous membrane is thrown into a cir-
r semicircular fold, which is called the *pyloric valve.*

*epithelium* of the mucous membrane of the stomach is thinner
at of the œsophagus, and is of the conoidal variety.

surface of the mucous membrane of the stomach presents
ıt appearances in different portions. These will be best seen
utely injecting the stomach of a child and washing off the
um.

left extremity and the great body of the stomach will e:
ıal *cells* or *alveoli,* which give it a honeycomb appeara
walls of these cells or pockets, as well as the ridges b
re composed of capillaries united by basement mem

These cells are larger in the cardiac extremity, and very regular in their appearance. The bottom of each cell is subdivided into smaller cells by the arrangement of the capillaries, and these smaller cells are the orifices of the *gastric glands* or tubuli which secrete the gastric juice. Near the antrum pylori the cells or alveoli are less numerous and smaller; and the ridges separating them are larger. Towards the pyloric valve there exist conical projections, which may be termed *gastric villi;* these villi are smaller than those of the intestine.

The lesser curvature is supplied by the gastric artery, the greater by the right and left gastro-epiploics, and the greater extremity by the vasa brevia. The nerves are derived from the par vagum and solar plexus of the sympathetic.

## INTESTINES.

The intestinal canal is from thirty to thirty-five feet in length, and is divided into large and small intestine.

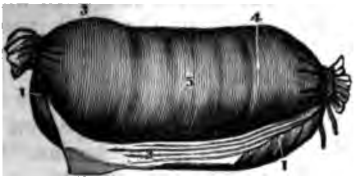
### SMALL INTESTINE.

The small intestine is four-fifths of the length of the whole canal, reaching from the pylorus to the large intestine; it is cylindrical, and about one inch in diameter, although there is a gradual diminution in diameter as it descends. It consists of four coats.

The *Peritoneal coat*[1] is the external coat, and is continuous with that portion of the peritoneum forming the mesentery.

The *Muscular coat* is thin, and consists of pale fibres; the superficial are longitudinal;[2] the remainder are circular,[3 4] and more distinct.

Fig. 87.



The *Cellular coat* connects the muscular and mucous, and contains the vessels and nerves; when inflated with air and dried, it appears like cotton, as is the case in the stomach.

The *Mucous coat* is continuous with that of the stomach, and covered with a conoidal epithelium. It is longer than any other, and hence must be thrown into numerous folds, which are called *Valvulæ Conniventes;* these are circular and overlapping, and more numerous[2] and larger[1] in the upper portion of the intestine than in the lower. They differ from other folds of mucous membrane in being permanent; distention does not remove them.

The surface of the mucous membrane is covered with a number illary projections, called *Villi*, which render it soft and vel-

ir shape varies in different parts of the intestine; in the upper
f the intestine they are more numerous, and resemble trian-
convolutions; in the lower they are more conical and cylin-
Their length varies from ¼th to ⅓d of a line. Each consists

Fig. 88.

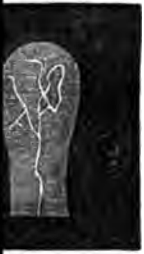
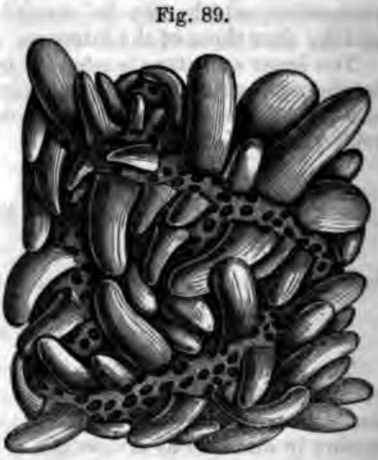


Fig. 89.



pillary network united by simple membrane, and communi-
with a small artery and vein. They contain also lymphatics
88), or lacteals, and a number of granular corpuscles and fat
The exterior is covered with a conoidal epithelium.

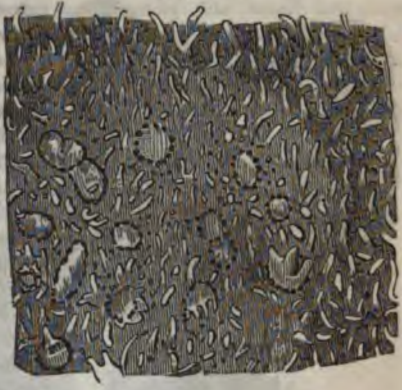
*glands* of the small intestine are the crypts or follicles of
rkühn, the glands of Peyer, the Solitary Glands, and Brun-
Glands.

*crypts* are the smallest of the glandular structures, and con-
nothing more than pockets or tubes opening by small orifices
ry part of the intestine. Their diameter is $\frac{1}{30}$th of a line.
are lined by epithelium.

*Glands or Patches of Peyer.*—These are all called *agminate.*
are oval clusters of small, round, flattened vesicles or capsules,
filled with a white semifluid matter, and situated beneath the
s membrane. When empty of fluid they are difficult of de-
. Their size varies from half an inch to four inches in
. Occasionally they are nine inches long.

y are more numerous in the lower part of the ileum, opposite
senteric attachment. There may be twenty or thirty in each
lual.

Fig. 90.



The *solitary* glands differ from the Agminate or Peyerian only in being separate. They are soft, white, rounded elevations, scattered over the whole surface of the mucous membrane of the small intestine. They frequently contain a white fluid, but like the vesicles of the Peyerian patch, have no orifice of discharge.

*Brunner's* glands are small round bodies in the upper part of the duodenum. They are compound glands, containing lobules and branched ducts, which open upon the intestine.

The mucous membrane of the small intestine is extremely vascular, and its absorbents are very numerous.

The arteries are derived from the superior mesenteric, and the nerves from the solar plexus.

The small intestine is divided into Duodenum, Jejunum, and Ileum.

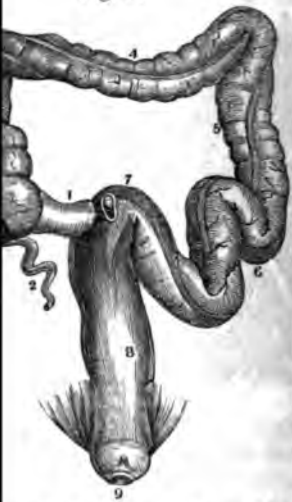
The *Duodenum* commences at the pylorus, and is about twelve inches in length. It is curved in its direction, and partially deficient in its peritoneal coat, on account of its being received between the two laminæ of the colic omentum. Its mucous coat is characterized by its colour, being tinged with bile, and by the great abundance of valvulæ conniventes in its lower part; the upper part contains the glands of Brunner. The *ductus communis choledochus* opens into the duodenum four or five inches from the pylorus, through a small elevation or tubercle.

The *Jejunum* (from jejunus, *empty*), constitutes two-fifths of the small intestine, and the ileum the remaining three-fifths. Although there is no anatomical reason for this division, it being impossible, from appearances, to say where the jejunum terminates or the ileum begins, yet if a portion of the upper extremity of the jejunum be compared with a portion of the lower extremity of the ileum, it could be recognised by its diameter, abundance of valvulæ conniventes, and the small number of *Peyer's Glands.* There are frequently *blind pouches,* varying in size from one to two inches, along the course of this small intestine.

## LARGE INTESTINE.

The large intestine reaches from the ileum to the anus, and is

Fig. 91.



one-fifth in length of the whole intestinal canal; it differs much from the small intestine in its diameter, and has a sacculated appearance. Like the small intestine, it consists of four coats.

The *peritoneal coat* is continuous with the meso-colon, and has numerous folds filled with fat, which are called *appendices epiploicæ*.

The *muscular coat* consists of two sets of fibres; the longitudinal fibres are collected into three bands, each about half an inch in breadth, which extend to the rectum; the circular fibres are also thicker than those of the small intestine.

The *cellular coat* connects the mucous and muscular, and
ns the blood-vessels and nerves.

*mucous coat* has no *valvulæ conniventes* nor *villi*; it is whiter,
r, and coarser, than that of the small intestine. Its *follicles*
pts are extremely numerous, and more readily discerned than
small intestine. They are very regular and uniform in their
ance, and consist of a capillary network, forming a pouch or
lined by conoidal epithelium. There are also some glands
ed over the mucous coat of the large intestine, which are
half a line in diameter. They consist of a dilated cavity
narrow orifice.

epithelium of the large intestine is columnar, and lines the
and glands.

large intestine is divided into the cœcum, colon, and rectum.

*Cœcum* is a cul-de-sac[3] (Fig. 91), and the commencement
large intestine, and hence is often called *caput coli*. It is
down into the right iliac fossa, by the meso-colon; its length
from one and a half to three inches, and its diameter is
r than that of any other portion of the alimentary canal, ex-
he stomach.

*appendix vermiformis*, is a worm-like process, of the thick-
f a quill, varying in length from three to six inches, and
ed to the inferior portion of the cœcum.[4] Its coats are the
as those of the intestine, and it usually contains flatus. Its
s or crypts are not so numerous or regular in their arrange-
and size as those of the other portions of the large intestine
hen injected, show a different arrangement of capillaries.

The *ileo-cæcal* valve[3] is an elliptical opening on the side of the cœcum, between its circular fibres, whereby the small intestine empties into the large. It is composed of two crescentic folds, the upper of which is the larger. Its action is such that the distention of the cœcum will prevent the passage of air or fluids backwards into the small intestine. (Fig. 93.) It is also called the *valve of Bauhin* or *Morgagni*.

The *Colon* is the longest portion of the large intestine; it gradually diminishes in diameter until it terminates in the sigmoid flexure on the left side.[6] (Fig. 92.) It ascends upon the right side, and forming an arch transversely, descends upon the left. The right side receives its arteries from the superior mesenteric, and the left side receives branches from the inferior mesenteric. The nerves are derived from the inferior and superior mesenteric plexuses of the sympathetic.

Fig. 92.

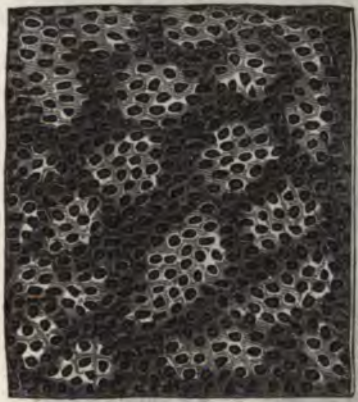
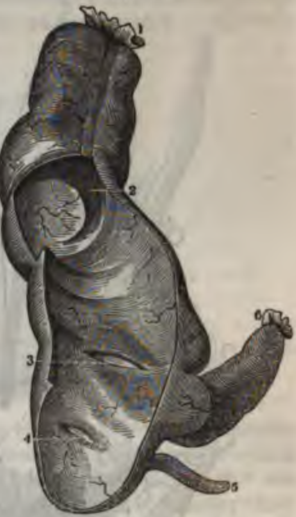
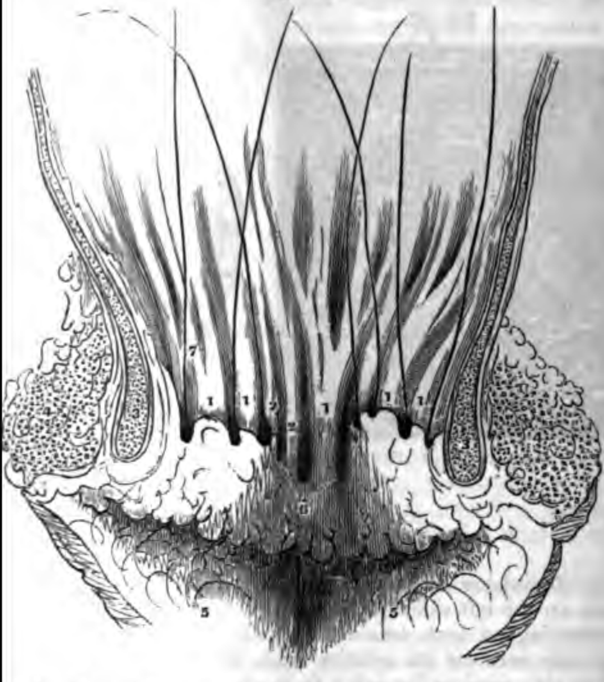


Fig. 93.



The *Rectum* is the terminating portion of the large intestine, and reaches from the sigmoid flexure to the *anus*, occupying a position in front of the sacrum. It is somewhat barrel-shaped, being larger in the middle than at either end. The *peritoneal* covering is deficient below and behind. The *muscular* coat has a very great *thickness* and redness. The external fibres are *longitudinal*, and the internal *circular*. The fibres of the external muscular coat wind around the inferior edge of the circular coat, and terminate in the us coat, which, in some measure, accounts for hæmorrhoids rolapsus ani. The mucous coat is thicker and redder than in pper part of the intestine, and at the lower extremity, just the anus, is thrown into a *number of pouches* between the udinal muscular fibres. (Fig. 94.) About five or six inches the anus, is a *semicircular fold* of the mucous membrane on ide of the rectum; these two are about half an inch distant

Fig. 94.



each other; they resemble the valvulæ conniventes, and in measure prevent the involuntary discharges of fæces.—The es of the rectum are the superior, middle, and inferior hæ oidal. The veins form a plexus around the bowel, which unicates with the internal iliac and portal veins. The nerves pplied from the sacral plexus, and from the hypogastric plexus sympathetic.

## THE LIVER.

*liver* is the largest glandular organ in the body, and secretes It is oblong and oval in its shape, and occupies the right hypochondriac, a portion of the epigastric, and left hypochondriac regions. It *weighs* from four to five pounds; it *measures* from ten to twelve inches transversely, and from six to seven antero-posteriorly; its greatest thickness is from four to five inches. It is convex upon its upper surface, and concave upon its lower. Its *colour* is of a reddish brown, with occasional spots of black. It is covered almost entirely by peritoneum, which, upon its upper surface, forms a broad *suspensory ligament*,[5] by means of which it is held in contact with the diaphragm. In the anterior edge of this ligament, is another, of a cordlike character, called *ligamentum teres*,[6] which was originally the umbilical vein. It passes through the anterior notch of the liver and umbilical fissure. Posteriorly, the two laminæ of the suspensory ligament diverge, forming the *coronary ligament*, under which the liver is destitute of peritoneum. The *lateral ligaments*[8 8] are also peritoneal, being, in fact, a continuation of the coronary; they are horizontal, and attach the right and left sides of the liver to the posterior walls of the abdomen. There is a deep depression upon the posterior edge of the liver, called the *posterior notch*, whereby the liver is adjusted to the vertebral column. The anterior and posterior notch divide the liver into *two lobes*, the right of which is much the larger and thicker, and the left terminates in a thin cutting edge.

Fig. 95.

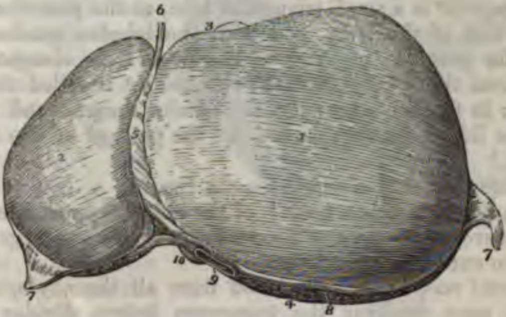
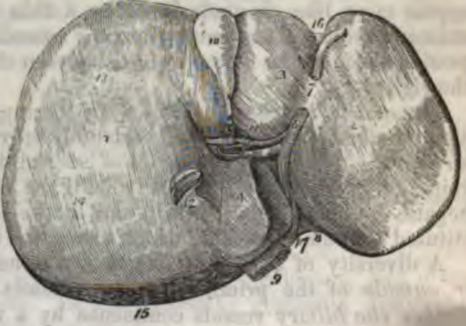


Fig. 96.



The under sur-

would not be a single sac. In the female there is a deficiency
extremity of the Fallopian tube.

mencing at the umbilicus to trace the peritoneum, it will be
o linc the anterior wall of the abdomen and under surface of
phragm, thence to cover the upper and a part of the lower
of the liver,[L] thence to pass to the stomach,[S] forming thus[4]
er lamina of the gastro-hepatic or lesser omentum; having
the anterior face of the stomach,[S5] it passes down to form
he laminæ of the apparently quadruple omentum—the gastro-
ascending again it forms another lamina, and surrounding
erior semi-circumference of the colon,[C] it passes to the verte-
lumn, forming the inferior lamina of the colic omentum,[7]
find it including the small intestine forming at the mesen-
from the vertebral column it can be traced over the upper
erior part of the rectum,[R] and over the posterior and superior
of the bladder,[B] forming at the vesico-rectal pouch,[11] and
e trace it to the umbilicus, the point whence we started.

in thus tracing it will be found, by the diagram, that we
t traced the peritoneum covering some portions of the viscera
lomen. In the dead subject it is very easy to introduce the
through a narrow passage which is called the *foramen of*
*w*, although there is no hole or tearing of the peritoneum.
ing for the posterior end of the gall-bladder and passing the
nder the vessels of the liver, it will be easy to touch the peri-
covering the posterior surface of the stomach. This cannot
onstrated very clearly from a drawing alone, which repre-
erely a longitudinal section of the abdominal cavity; and
explanation it gives the false idea of there being two sacs
of one. In the subject, however, by placing the finger upon
ler surface of the liver, we trace the peritoneum through the
n of Winslow; there it forms the inferior lamina of the lesser
m,[4] thence it covers the inferior surface of the stomach;
ling it forms the third and ascending at [6], it forms the fourth
of the great omentum; then it covers the superior convexity
olon, and forming the superior lamina of the colic omentum
ascends in front of the duodenum and pancreas,[PD] and passing
the foramen of Winslow, we can trace upon the posterior and
portion of the liver, the point of starting.

*mesentery* is formed of two laminæ of peritoneum, and serves
ect the small intestine to the parietes of the abdomen. Its
about six inches wide, and its inferior edge equals in breadth
ole length of the small intestine. Between these two
oneum are the superior mesenteric artery and vein, ly
and vessels, and branches of the sympathetic nerve, t
portion of fat and cellular tissue.

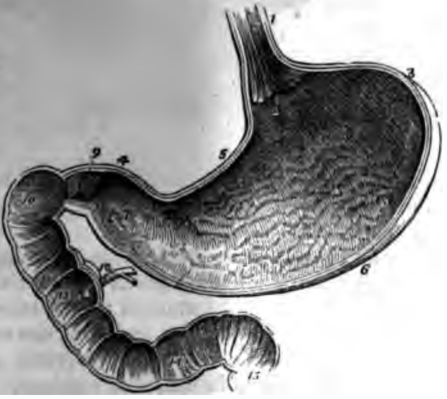
*meso-colon* is also formed of two laminæ of peritoneu holds the large intestine in its place. The transverse portion is long and loose, but on each side in the iliac regions it is short, and binds the intestine down very tightly; it also contains between its laminæ, vessels and nerves, together with some fat and cellular tissue; that portion which is attached to the rectum is called the *meso-rectum*.

## THE STOMACH.

The stomach is a conoidal sac, somewhat bent or curved, and is situated in the left hypochondriac and epigastric regions. It is somewhat flattened anteriorly and posteriorly, and thus presents an anterior and posterior face; its direction is oblique from above downwards, and from left to right. The left[3] extremity is much the larger, and terminates in a rounded cul-de-sac; at the superior portions of this extremity is the *cardiac* orifice, where the œsophagus is continued into the stomach immediately below the diaphragm. The right extremity gradually diminishes in size, and its orifice is called *pyloric*,[9] which is continuous with the small intestine. The structure of the pylorus is much thicker than that of any other portion.

The stomach is held in its position by the œsophagus and the duodenum, as well as by peritoneal reflexions. The right end is lower and more anterior than the left.

Fig. 85.



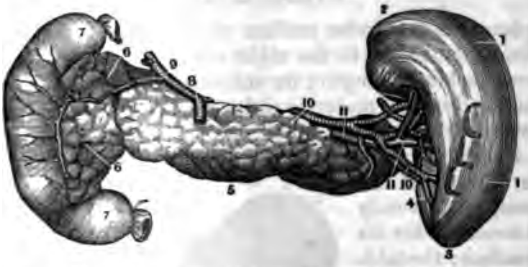
The upper and lower curvatures of the stomach are called the greater and lesser curvatures.[5 6] Near the pyloric extremity of the stomach, is a slight dilatation[7] called *antrum pylori*. The dimensions of the stomach are variable, depending upon the mode of life. It consists of four coats; peritoneal, muscular, cellular, and mucous.

The walls of the stomach consist of four distinct coats.

The *Serous or Peritoneal coat* completely covers the stomach, except at the curvatures, where are attached the omenta; the looseness of the omental connections at these points admits of the distension of the remaining coats.

The *Muscular coat* is not so thick as that of the œsophagus, and superior edge of the pancreas has a *groove* for the passage of nic artery.[8, 9, 10] Its *structure*, like that of salivary glands, lomerate. Its excretory *duct*, called after *Wirsungius*, is

Fig. 98.



by a collection of small branches, which come from the lo- f the gland. The walls of the duct are thin, white, and , gradually increasing in size; it *opens* into the duodenum c orifice of the ductus communis choledochus, and some- nto it. Its arteries are branches of the splenic.

## SPLEEN.

spleen is contained in the left hypochondriac region. It is ascular organ of a purplish colour. It has no duct, and it is re not a true gland.

shape of the spleen is irregular and variable, but it is gene- section of an ovoid, with a convex surface resting against the gm, opposite the ninth, tenth, and eleventh ribs, and a con- rface directed towards the stomach; this surface is divided dinally by a fissure or hilum, which transmits the blood-

covered by the peritoneum, which appears wrinkled when een is bent. Reflections of the peritoneum from the stomach phragm, called gastro-splenic and splenico-phrenic omenta, e spleen in its position. The edges of the spleen are fre- notched, and occasionally small additional spleens are found ed with it.

ries in size more than any other organ in the body. It is ly five inches long and three wide, and weighs from five to unces. Besides its peritoneal coat, it is covered by an in- elastic tunic, which is of a white colour, and com tissue. In some animals muscular fibres are found rom this tunic are prolonged numerous bands, which an in all directions. In the interstices of these læ the vessels ramify.

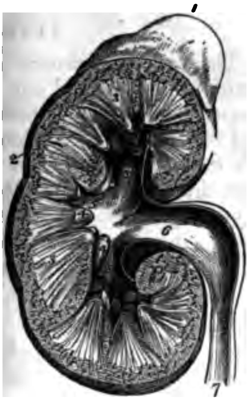
The proper substance of the spleen is a soft pulpy mass, of a reddish brown colour, resembling grumous blood, contained between the trabeculæ and outside of the venous plexus. It consists of rounded granules, about the size of the blood corpuscles. Beside these, there are the corpuscles of Malpighi, which are white capsules, varying in diameter from the $\frac{1}{30}$th to $\frac{1}{60}$th of an inch. They contain a soft, white, semifluid matter, which is composed of granules, resembling in size the red corpuscles of the spleen. The lymphatics of the spleen are very numerous.

The *splenic artery* is the largest branch of the cœliac, and divides into four or five branches before it enters the spleen. The splenic vein empties into the portal vein.

## KIDNEYS.

The kidneys are two hard glands for the secretion of urine, placed in each lumbar region, and reaching from the first to the third lumbar vertebræ; they are outside of the peritoneal cavity, and surrounded with an abundance of fat and loose cellular tissue. The *right kidney* is rather lower than the left, on account of superposition of the liver. The *length* is four inches, and the breadth two inches. The *shape* is oval, resembling a bean; the position is upright, and the *fissure* or *hilum* is directed inwards towards the vertebral column. The upper end of the kidney is rather larger than the lower. It is covered by a strong *fibrous capsule*. The *colour* is of a reddish brown. Upon making a longitudinal section of the kidney, *two* different *structures* are presented. The *internal* is of the darker colour, and consists of about fifteen cones of Malpighi, which are arranged in three rows, their apices converging towards the hilum. These constitute the *medullary* portion. The *external* structure is of a lighter colour usually, is extremely vascular, and of a granulated arrangement; it constitutes the *cortical* portion.

Fig. 99.



The *cortical* substance[*] consists of a number of *tortuous tubes of Ferrein*, in which the urine is first formed, and between whose walls are a number of small bodies, called the *corpuscles of Malpighi.*

Mr. Bowman says that the end of each tube is dilated and receives the Malpighian bodies. These bodies are a tuft of capillaries, of about $\frac{1}{120}$th of an inch in diameter. They are supplied by a small and from them emerges a vein, which afterwards forms a on the uriniferous tubes.

*medullary* cone of Malpighi[3] is capable of subdivision into *yramids of Ferrein,* and each pyramid of Ferrein will be o consist of a number of straight *tubes of Bellini,* which are tinuations of the tortuous tubes of Ferrein.

apex of each cone is called *papilla renalis,* and in the centre papilla is a slight depression, called *foveola.*

papilla is surrounded by a small membranous cup, called *ibulum,*[4] into which the urine is first received as it oozes e orifices of the papillæ. Four or five of these infundibula form a common trunk, called *calyx,*[5] and the junction of about alyces form a common cavity, called the *pelvis,*[6] which is of dal shape, and from which proceeds the *ureter,*[7] the excretory the kidney, which conveys the urine to the bladder.

*ureter*[3] is a cylindrical tube of the size of a quill, with thin, extensible walls. Crossing in its descent the iliac artery, it he inferior fundus of the bladder very obliquely, and opens ry small orifice. It consists of two coats, the external of s fibrous, and the internal is mucous. The structure of the and infundibula is the same.

### SUPRA-RENAL CAPSULES.

*capsulæ renales*[1] (Fig. 99), are two small bodies, varying n size, placed one on each side, just above the kidney, and g on its upper extremity. They are of a light brown colour, rounded by condensed cellular tissue. In fœtal and youthful y are much larger than in adult life, and hence it is supposed e use is confined to that period of life, as in the case of the gland. They are of a triangular or semicircular shape, the ing excavated where it is adjusted to the kidney. Having etion, they of course have no duct.

are supplied by the *capsular* artery, a branch of the renal r the aorta.

### WOLFFIAN BODIES.

e structures exist only until the sixth month of fœtal life. this period they conceal the kidney and renal capsule. They of tubes which empty into the sinus uro-genitalis, a duct r to fœtal life.

### BLADDER.

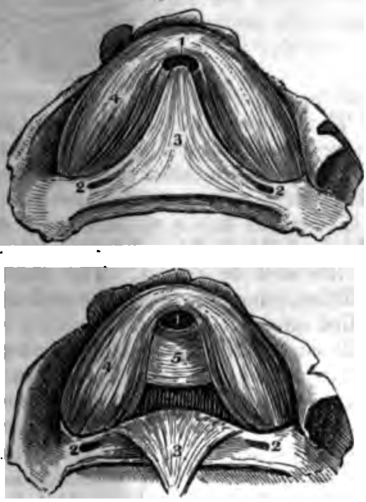
bladder is a musculo-membranous sac for the rece It is situated in the cavity of the pelvis, behind th pubis, and in front of the rectum, in the male; but the uterus and vagina are between the bladder and r nnected with the umbilicus by means of a kind of lig *he urachus.*[1] (Fig. 101.)

Its *shape* is oval, the larger end being downwards; in women it is more spheroidal; in children it is pyriform. It is divided into a superior and inferior *fundus*, a *body*, and *neck*.

Its *dimensions* vary with health and disease. An ordinary healthy bladder will hold nearly a pint. The *round ligaments* of the bladder were formerly the umbilical arteries, and are contained in folds of peritoneum on each side of the superior fundus; besides which, the bladder is held in its place by the *anterior* and *lateral* ligaments, which are processes of the pelvic fascia.

The bladder has four coats, viz., the *peritoneal*, which only covers the posterior part of the body and superior fundus. The *muscular* coat is thicker than that of the intestine; the fibres are pale and unstriped. The external fibres are more longitudinal, and the internal more transverse or circular in their course, and pass in various directions. The *cellular* coat is thick and dense, very distensible and impervious to water. It connects the muscular and mucous coats and transmits the vessels and nerves. The *mucous* coat is soft, smooth, and of a light pink colour. It is covered by an epithelium. It has numerous follicles, which are exceedingly small. The *vesical triangle* is a space within the cavity of the bladder, and included between the two orifices of the ureters[4] and the orifice of the urethra. In the anterior angle there projects in the bladder the *uvula vesicæ*, a prominence of the third lobe of the prostate, covered by the mucous membrane. Under the mucous membrane of the vesical triangle is a plane of fibres,[3] connected with the orifice of the ureters,[2] and that of the ductus ejaculatorius. Surrounding the neck of the bladder is the *sphincter vesicæ*, which consists of a semicircular[4] and a transverse[5] set of fibres.[1] The latter are partly composed of yellow elastic fibres. (Fig. 100.)

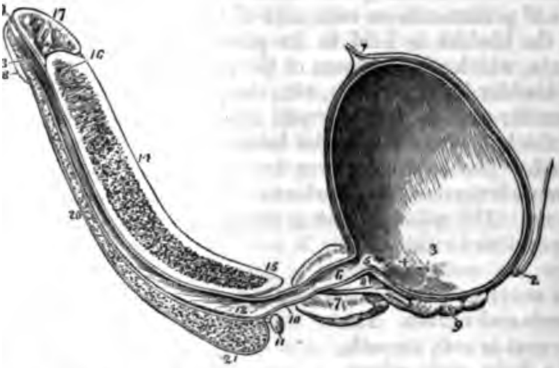
Fig. 100.



PENIS.

The penis conveys the urine from the bladder, and the semen into the female. The anterior extremity or head is the glans,[17] the or extremity is the *root*, and the intervening part is the *body*, onsists of two structures, the *corpus cavernosum* and *corpus* sum.

Fig. 101.



skin of the penis is thin and delicate, and has numerous ind sebaceous follicles. Surrounding the glans is a loose ıg of skin called the *prepuce*, which is connected to the orifice ırethra by a vertical process called the *frænum*.

glans has a thick rim or edge around its base, the *corona* , behind which the penis is narrow, and this portion is known *neck* or *collum*. The *glands of Tyson* are the sebaceous , numerous about the *neck* and *crown*, and whose secretion is *megma*.

ath the skin is the *fascia* of the penis, which is formed of sed cellular tissue, and is in fact a continuation and modifi- of the superficial fascia of the abdomen. That portion of the hich passes from the pubes to the penis is the *ligamentum* *orium*, which is triangular in shape and vertical in position, tero-posterior in direction. The fascia of the penis may be be formed by the penis being included between two laminæ ligament.

*corpus cavernosum* forms the largest part of the penis, and ape a double cylinder. At the root these cylinders are sepa- d pointed, and called the *crura*[15] of the penis—each crus is ıttached to the ramus of the pubes and ischium, const gin of the penis. *Externally* the corpus cavernos by a dense, thick, fibrous, and elastic coat. *Intern* of a spongy structure made up of cells, which readil te with the arteries and veins. There are some a which do not terminate, however, in these cells, but in blind tufts, called *helicine arteries.* The two cylinders are partially separated from each other by the *septum pectiniforme*, a partition which is more complete behind than before, and whose fibres being vertical, somewhat resemble the teeth of a comb, whence the name.

The *corpus spongiosum*[20] occupies the same position with relation to the corpus cavernosum, as a ramrod does to a double-barrelled gun; being contained in a longitudinal groove on its inferior surface, the nutritious vessels occupying a corresponding position above. It is covered by a dense fibrous covering also, but it is thinner than that of the corpus cavernosum. *Internally* it is composed of cells, which are larger than those of the corpus cavernosum.

Posteriorly it touches the triangular ligament; this extremity is enlarged into what is called the *bulb*,[21] which lies between the divergent crura of the penis; anteriorly it forms the glans penis.[17]

The *urethra* is the urinary canal or tube from the bladder, and perforates the corpus spongiosum. It consists of two coats; the external is formed of yellow elastic tissue, and a few involuntary muscular fibres; the internal is mucous, and continuous with that of the bladder. The course of the urethra is curved and its diameter varies.

The first part perforates the upper part of the prostate gland, and is termed the *prostatic portion*;[8] this is an inch in length, and in it we find the *uvula vesica* behind and looking into the bladder; and a triangular elevation of mucous membrane in front, called the *caput gallinaginis* or *verumontanum.* In front of the caput gallinaginis is the utriculus, a small pocket into which empty the ejaculatory ducts. On each side there is a groove perforated with the orifices of the *prostatic ducts.*

The next portion is the *membranous*;[10] this is eight or ten lines in length, and is very narrow; it perforates the triangular ligament, and it is surrounded by loose tissue, and a few muscular fibres called the muscle of Guthrie or compressor urethræ.

The urethra now perforates the bulb of the corpus spongiosum, not directly at its pendulous tip, but through its superior convexity just in advance of its extremity. This portion is the longest, and commences with an enlargement called bulbous;[12] gradually it diminishes in diameter until it reaches the glans, in which it again enlarges and constitutes the *fossa navicularis.*[13] When the urethra is relaxed, longitudinal folds exist in this portion. Numerous mucous follicles are also readily seen, of which the largest is in the *fossa.* The orifices of Cowper's glands open obliquely upon the mucous membrane also, about an inch in front of the glands.

The penis is supplied by the internal pudic arteries and pudendal nerves.

### VESICULÆ SEMINALES.

seminal vesicles consist of two convoluted tubes placed at
sterior and inferior portion of the bladder. They are oblong
e, and converge downwards and forwards. Each appears to
ut two inches in length, but when cleanly dissected and un-
d, it is a tube five inches in length, with numerous pouches

duct of the vesicle is joined by the vas deferens on either
the prostate gland; the junction forms the *ductus ejacula-*
which, passing through the prostate, opens into the urethra
t of the caput gallinaginis. They contain a mixture of
and semen.

### PROSTATE GLAND.

is a dense hard structure, about the size of a horse-chestnut,
urrounds the neck of the bladder and the commencement of
thra. It is of a light colour, and somewhat triangular in
the point being in front. It is placed between the rectum
is behind, and the triangular ligament in front.
enveloped in a fascia, which is continuous with the posterior
of the triangular ligament; it may be divided into two
and a middle lobe. The urethra perforates the middle lobe,[8]
projection of the uvula vesicæ and verumontanum are par-
ormed by it.
tructure is composed of tubes united by condensed and hard
tissue. The secretion is thick and white, and is discharged
es into the urethra on each side of the verumontanum.
*er's glands.*[11]—These are two in number; placed in front of
state, and included between the two laminæ of the trian-
igament. They are about the size of a pea, and of a yellow
secreting a mucous fluid which is discharged into the ure-
out an inch in front of the gland.

### SCROTUM AND TESTICLES.

scrotum is a bag-like covering for the testicles, formed exter-
f skin, which is of a dark colour, and thickly covered by
d studded with sebaceous follicles. The skin is loose and
n its middle is a ridge still darker in colour, which reaches
e anus to the prepuce, called the *raphe.* The transverse
s of the scrotum which cold produces, are due to a structure
ately beneath and intimately connected with the skin, called
tos.
*dartos* is a dense, reddish, contractile covering, divide
n into two bags. It was once considered muscular, an
of the gubernaculum testis; it is principally compos

the yellow fibrous elastic tissue, with a few unstriped or involuntary muscular fibres. Its contractions are involuntary.

The position of the testicle in fœtal life, and its descent, have been noticed under the head of inguinal hernia. Beneath the dartos is a covering of intercolumnar or external spermatic fascia, and the superficial fascia.

The *cremaster* muscle sends a few fibres and loops upon the anterior and upper part of the testicle, and is sometimes called the tunica erythroides.

The next covering is that derived from the fascia transversalis and infundibuliform fascia. It is sometimes called the internal spermatic fascia, and also tunica vaginalis communis testis; by Cooper it is called the fascia propria.

The *tunica vaginalis or peritestis*, is the next covering. It is a serous membrane lining the cavity and reflected over the testicle within; it was originally peritoneum, and is the seat of hydrocele.

The *testicles* are the glands for the secretion of semen. They are two in number, oval in shape, and flattened laterally. They hang obliquely by the spermatic cord, being attached above the middle of the posterior edge; the right is higher than the left.

The *tunica albuginea*,[a] is the dense, white, thick, fibrous coat of the testicle, which gives it shape. In structure it resembles the dura mater or sclerotica; externally it is covered by a portion of the peritestis, which is transparent and very closely adherent; from its internal face are given off numerous partitions called sep-

Fig. 102.

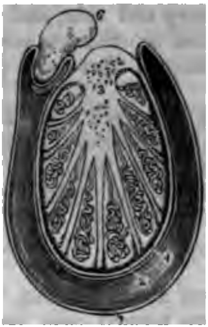
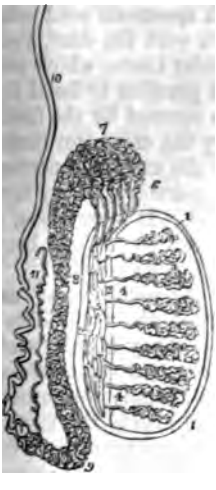


Fig. 103.



*stes*, and which, uniting at the posterior edge of the testicle, nat prismatic ridge termed *corpus Highmorianum.*[3] testicle is formed by *lobules*, each placed within the spaces n the septulæ. Each lobule[3] consists of a very fine tube, nely convoluted. Upon its exterior is a capillary network of essels; interiorly it is lined by epithelium. This tube (*tu- seminiferus*), becoming straight forms the *vas rectum;*[4] the of the vasa recta makes the *rete testis,*[5] which is in the corpus iorianum; from the upper part of this rete proceed 15 or 20 hrough the tunica albuginea; they are called *vasa efferentia;*[6] is efferens is convoluted in a conical form, and termed *conus sus;* the union of the coni vasculosi forms the commencement epididymis.

*epididymis*[8] is that vermiform appendage encircling the pos- dge, as a crest upon a helmet. It is soft and formed of a convoluted tube, originating by the junction of the bases of ni vasculosi. The upper extremity is the larger, and called *major,*[7] and the lower is *globus minor.*[9] From the globus this tube ascends in a less convoluted form, under the name *vas deferens,*[10] which forms one of the constituents of the Connected with the epididymis is the *vasculum aberrans,*[11] l, blind, convoluted duct.

## SPERMATIC CORD.

1 spermatic cord consists of an artery and vein, and nerves, r with the duct, vas deferens. These constituents are united ular tissue, which may be the remains of that canal of peri- peculiar to fœtal life.

covered by the fascia transversalis prolonged from the abdo- y the cremaster muscle, which has been previously described; the external spermatic or infundibuliform fascia.

*spermatic artery* comes from the aorta, and sometimes from ial. It is tortuous, and after passing through the rings di- nto two or three branches; the termination of the artery is than its origin.

*spermatic* veins are very tortuous and numerous, and on of their vine-like appearance are termed *vasa pampini-* . They are the seat of circocele.

*external spermatic nerves*, and also branches of the abdomi- al, supply the muscular structure; filaments of the sympa- un also to the testicle.

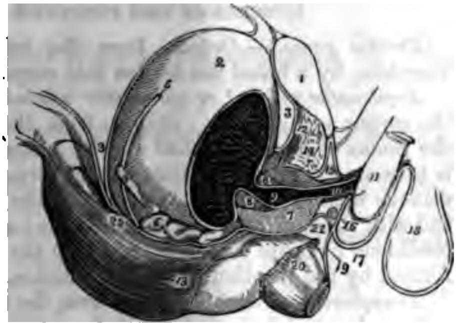
*vas deferens* is a continuation of the epididymis. Passing h the cord and rings, it descends behind the bladder and t of the vesiculæ seminales. It is very hard, and sed by touch; its walls are extremely thick, and its capillary. It is nearly white, and thicker than a kni

## THE PERINEUM.

The perineum is that space included between the anus, arch of the pubes, and the tuberosities of the ischia.

In a proper dissection the removal of the skin reveals the *superficial fascia*, which is continuous with the superficial fascia of other parts of the body. When this is removed, the *perineal fascia* is exhibited, which is a dense, thin, and tough fascia,[17] adhering to the rami of the pubes and ischium on each side; in front it is continued into the scrotum; behind it is continuous with the base of the triangular ligament by its anterior lamina,[16] and also with the *anal fascia*,[18] a portion of the pelvic fascia. It covers the muscles of the perineum and sends processes between them. Posteriorly it winds around the transversus muscle to join the triangular ligament. Its connections laterally and behind account for the course taken by extravasated urine from rupture of the urethra.

Fig. 104.



The *triangular ligament*[16] called also deep perineal fascia, lies under the muscles of the perineum, fills up the arch of the pubes, and is shaped as its name implies. It is a fibrous membrane, separating the pelvis from the perineum. The base, which is not so dense and fibrous as its apex, joins the perineal and anal fascia.[21] It is perforated by the membranous portion of the urethra, about one inch below the symphysis.

It consists of two laminæ,[16 21] between which are situated Cowper's and the prostate gland;[7] thus the fascia of the prostate, as it is usually called, is merely the posterior lamina of the triangular ligament.

## PELVIC FASCIA.

This fascia is continuous with the transversalis and iliac fascia surrounding that portion of the peritoneum which lines the pelvis. Like all fasciæ, it is easily divided into laminæ; different portions receiving different names.

It may be said to commence at the brim of the pelvis, and by its intervention the different viscera are united with each other, and held in their proper positions. Thus, two processes of it on the sides of the form the *anterior ligaments of the bladder.* A layer cover- obturator muscle is called the *obturator fascia.* The levator scle is included between two layers of this fascia; that portion 1 the rectum and bladder is called the *recto-vesical fascia;* and ich covers the lower part of the rectum is the anal fascia.

## MUSCLES OF THE PERINEUM AND ANUS.

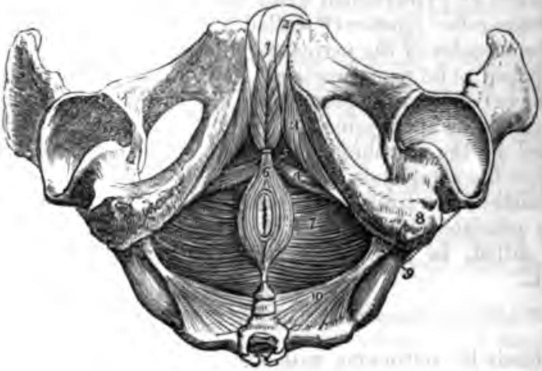
*tor penis.*[3]—*Origin,* from the tuberosity of the ischium. *n,* by a broad flat tendon into corpus cavernosum.

*lerator urinæ,*[1] *or ejaculator seminis.*—It lies on the bulb of pus spongiosum. *Origin,* from the crus of the penis, and ius of the pubes; and also by a tendinous membrane which en the corpus spongiosum and corpus cavernosum, and is con- with the fascia of the penis. The fibres are semi-pennate, h those of its fellow surround the bulb. *Insertion,* by a white us line into its fellow, and into the *perineal centre,* which is by the junction of several muscles.

*usversus perinei.*[4]—*Arises* from the tuberosity of the ischium, *inserted* into the perineal centre. Sometimes there is an nal portion in front, called *transversus perinei alter.*

*ncter ani.*[6]—A thick muscular ring surrounding the anus. Its ial fibres are elliptical. It is connected with the coccyx ineal centre.

Fig. 105.



*ygeus.*[10]—*Origin,* from the spine of the ischium. *In* side of the coccyx and last bone of the sacrum.

*o-coccygeus.*—A few fibres passing from the sacrum in front.

*Levator ani.*[7]—Is a plane of muscular fibres. *Origin*, from the interior of the body of the pubes, the superior edge of the thyroid foramen, the upper edge of the obturator fascia, and the spine of the ischium. *Insertion*, by converging and descending fibres into the lateral semi-circumference of the rectum; also in the coccyx and perineal centre.

## ORGANS OF RESPIRATION AND CIRCULATION.

### LARYNX.

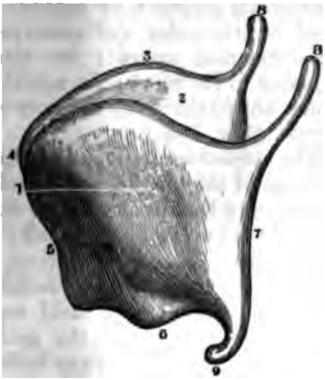
The *larynx* is a canal formed of cartilages, which move in such a manner as to regulate the voice.

It is situated in the upper and anterior part of the neck, in the median line, below the hyoid bone.

It forms the commencement of the windpipe; is cylindrical below but prismatic above; it is larger in males than in females.

The cartilages of the larynx are five in number; thyroid, cricoid, two arytenoid, and epiglottis.

Fig. 106.



The *thyroid* is the largest; it occupies the upper and anterior portion of the larynx. It consists of two quadrilateral plates, which are united in an acute angle in the median line in front; this angle is usually called the *pomum Adami*,[3] which is much larger in men; it has a deep notch at its upper part.[4] The upper edge[5] is curved, and has the middle thyreo-hyoid ligament attached to it; the lower edge[6] is also curved, and to it is attached the middle crico-thyroid ligament. The posterior edge terminates in two processes called cornua, of which the superior[8] is the longer, and is attached to the lateral thyreo-hyoid ligament. The *inferior cornu*[9] is short and curved, and receives the lateral crico-thyroid ligament. Upon the external surface[1] is an oblique ridge, passing between two tubercles, from which arise the thyreo-hyoid and inferior constrictor muscles.

The *cricoid cartilage* is next in size (Fig. 107), and situated at the base of the larynx; its form is that of a thick ring compressed laterally; its lower edge[3] is circular, and attached to the trachea; its upper edge is oval and oblique, on account of the cartilage being three times as thick behind as it is in front; the posterior portion of the superior edge has *two heads*[4] of a peculiar convexity, for *articulating with the arytenoid* cartilages; the external surface poste-s flattened, giving origin to the posterior crico-arytenoid

Fig. 107.

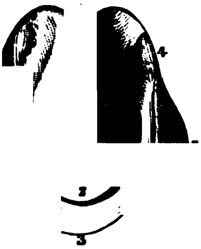


Fig. 108.

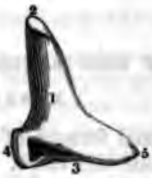
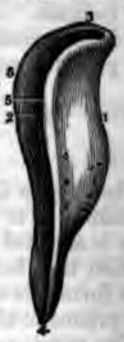


Fig. 109.



*ırytenoid cartilages* are situated at the upper and back por- the larynx. They are two in number, and are of a pyramidal The base[3] is concave, and articulates with the heads of the ; the apices[2] have attached to them a small cartilage called *lum laryngis*, or *tubercle of Santorini.* The posterior sur- ı triangular and concave, for the insertion of the posterior ytenoid muscle; the internal surface is flat, and can be l to its fellow; the anterior or external surface is uneven, to ıre attached the superior and inferior thyreo-arytenoid liga- (Fig. 108.)

*:piglottis cartilage* is a thin, oval, cartilaginous plate, behind ; of the tongue, and attached to the angle of the larynx; it ıcs a leaf in shape; its direction is vertical; its inferior ex- [4] is narrow and pointed; its superior edge is thin, its ante- rface[1] is slightly convex, and its posterior[2] concave. It is ted by numerous foramina. (Fig. 109.)

e cartilages are held together by numerous ligaments, of he principal are, the *middle thyreo-hyoid;* a thin membra- pansion between the inferior circumference of the hyoid bone superior edge of the thyroid cartilage: the *lateral thyreo-* which is funicular, extending from the great cornu of the cartilage to the tubercle of the cornu of the hyoid bone; in ınd a small oval cartilage or bone, called *cartilago triticea; ldle crico-thyroid,* a thick membrane, filling up the space be- :he superior edge of the cricoid and inferior edge cartilages; this is usually divided in the operation of ; and the *lateral crico-thyroid,* reaching from the i f the thyroid to the side of the cricoid; a *capsular li* ds the joint between the arytenoid and cricoid.

*in the* larynx are two thyreo-arytenoid ligaments on side. The *inferior* ligaments extend from the angle of the thyroid to the base of the arytenoid, and are usually called the vocal cords; the space between them is the *rima glottidis.* The *superior* ligaments extend from the angle of the thyroid to the middle of the arytenoid cartilages. The space between them is the glottis. These ligaments are not cords, as they appear to be, but merely edges of a membrane lining the larynx, and composed of yellow elastic fibrous tissue.

The mucous membrane lining the larynx is continuous with that of the mouth, and forms numerous folds between the cartilages, of which the most remarkable is a pouch between the superior and inferior thyro-arytenoid ligaments, which has been called the *ventricle of the larynx,* or ventricle of Galen. To the ventricle of either side is attached an additional pouch, which is called the *sinus of Morgagni.* In the fold between the arytenoid and epiglottis cartilages is a small *gland,* called the *arytenoid,* which is of the shape of the letter L.

*The muscles of the larynx* move the various cartilages, and modulate the voice.

*Thyreo-hyoid.*—This was described with the muscles of the neck.

*Crico-thyroid,* arises from the anterior and lateral surfaces of the cricoid, and passes backwards to be inserted into the inferior cornu of the thyroid; it draws these two cartilages together obliquely.

*Posterior crico-arytenoid,*[7] arises from the flat surface on the back of the cricoid, and is inserted into the posterior part of the base of the arytenoid; it draws the arytenoid backwards, and thus tightens the vocal ligaments. (Fig. 110.)

*Lateral crico-arytenoid.*[a]—Arises from the side of the cricoid, and is inserted into the side of the base of the arytenoid; it separates the arytenoid from its fellow, and widens the glottis.

*Thyreo-arytenoid.*[a]—Arises from the posterior face of the thyroid near the angle, and is inserted into the anterior surface of the arytenoid, which it draws forwards, and thus relaxes the vocal ligaments.

*Oblique arytenoid,*[a]—They consist of oblique fibres arising from the top of one cartilage, and inserted into the base of another. (Fig. 111.)

*Transverse arytenoid.*[8]—Arises from the side of one cartilage, and is in-

Fig. 110.

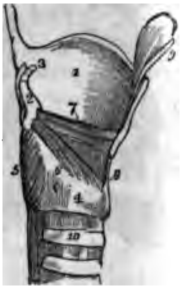
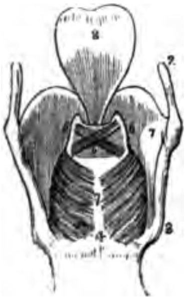


Fig. 111.



nto the side of the other. These last two muscles are often red as one, and by them the glottis is narrowed.

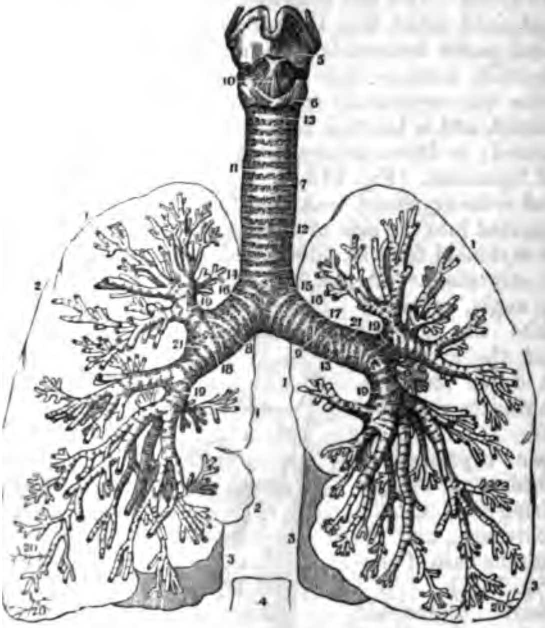
*eo-epiglottideus.*—Consists of a few fibres passing between vo cartilages.

*eno-epiglottideus.*—A few indistinct fibres passing between ilages from which it derives its name. These last two draw glottis downwards.

## TRACHEA.

trachea is a cylindrical tube, four or five inches in length, g from the larynx as low as the third dorsal vertebra, where es into the *bronchi.* It is formed of from *sixteen* to *twenty* f *cartilage*, united by *ligamentous* tissue, which is of an character. Each ring is about two lines broad and con- two-thirds of a circle; the first ring is the largest, and the g is of such a shape as to be adapted to the first rings of the .

Fig. 112.



posterior third of the trachea is completed by an invol r structure, whose fibres are transverse, and the contr of which diminishes its diameter, by which expectoration is facilitated; it is lined by a *mucous membrane* continuous with that of the larynx, which is extremely vascular, and covered with numerous follicles. At the bifurcation of the trachea into the bronchi, there are a number of hard, *black* glands, which are lymphatic in their character, and called *bronchial* from their position.

The *bronchi* are essentially of the same structure and arrangement as the trachea; the right bronchus is shorter, and of a larger diameter than the left; they soon ramify into numerous subdivisions, which finally terminate in the lobules of the lungs. In the smaller ramifications of the bronchi there is some modification of structure; the tube is no longer flattened behind, because the cartilages form complete circles; the cartilages are less numerous; each cartilaginous ring is not composed of a single piece, but of several segments of a circle; there is also a semilunar cartilage at each of the lesser bifurcations.

## THYROID GLAND.

It is situated in front of the first two rings of the trachea, and upon the sides of the larynx; it consists of two lateral lobes, placed on either side, united by a narrow isthmus in front; it is extremely vascular, of a reddish-brown colour, and of tolerably firm consistence. A process called the pyramid or middle lobe sometimes extends from the isthmus to the hyoid bone. Occasionally a small, narrow muscle attaches one lobe to the hyoid bone. It is granular in its structure, has no excretory tube, but very large lymphatic vessels. It consists of minute closed vesicles, surrounded by capillary vessels, and invested by areolar tissue. These vesicles are composed of an external capsule, and a yellow fluid containing corpuscles resembling cell-nuclei: albumen enters largely into the composition of the fluid. It is supplied by the superior and inferior thyroid arteries. It is sometimes much enlarged, constituting bronchocele or goitre.

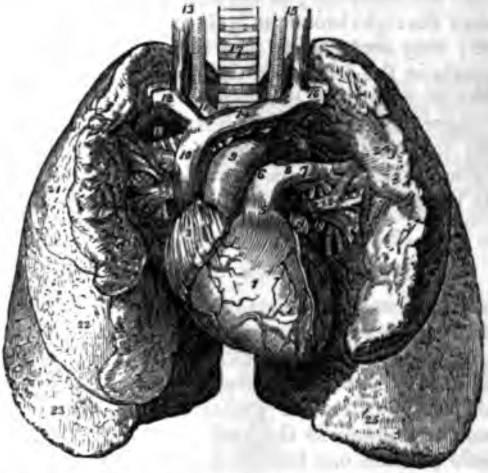
## THE LUNGS.

The lungs are the organs of respiration properly; they are two in number, and situated in the thorax, placed side by side, being separated from the abdomen by the diaphragm. The size varies with the capacity and condition of the thorax, age, inspiration, expiration, and disease. They are conical in shape, are longer posteriorly than anteriorly, and have concave bases. The colour of the lungs is of a pinkish-gray, mottled with black; these black spots are more numerous in adult life than in infancy.

The right lung is shorter but larger than the left, whose transverse diameter is somewhat diminished by the position of the heart. It has three lobes, the left having but two.

The *structure of the lungs* is spongy, and its compression between gers produces a crackling called *crepitation.* It consists of a r of air-vesicles held together by cellular tissue, called *paren-*; through which blood-vessels and air-vessels are ramified. ain number of air-cells communicate with each other, and

Fig. 113.



single branch of the bronchial tube; these are separated eighbouring cells by partitions of parenchyma, and thus are *lobules.* These subdivisions are evident upon the external of the lung. The air-vesicles are formed of ligamentous ined by a mucous membrane.

*root* of the lung, consists of the bronchus, pulmonary artery, lmonary veins, bronchial artery and vein, nerves, and lym-. These enter upon its internal surface, and in some degree the lung in its proper position. The branches of the pulmo-tery terminate in capillaries, upon the walls of the air-vessels, hich arise the branches of the pulmonary veins.

bronchial artery is the nutritious artery of the lung. Its are derived from the sympathetic and eighth pair.

## PLEURÆ.

pleura is a serous membrane investing each lung, and then d upon the parietes of the chest. That portion in c ie chest is called *pleura costalis;* that covering the *pulmonalis.* It also covers the diaphragm and the root etween which there exists a fold called *ligamentum pu*

### MEDIASTINUM.

The space between the two pleuræ of the lungs is called the mediastinum, and it is divided, by the position of the heart, into the anterior, posterior, and superior mediastinum.

The *anterior mediastinum* is that space between the sternum and the heart; it contains some loose cellular tissue, and a portion of the remains of the thymus gland.

The *posterior mediastinum* is that region between the vertebral column and the heart, and through it passes the œsophagus, par vagum nerve, aorta, vena azygos, and the thoracic duct.

The *superior mediastinum* is above the heart, and surrounded by the first ribs and sternum; it contains the roots of the large vessels, and the remains of the thymus gland.

### THYMUS GLAND.

This is a triangular body of a pinkish hue, occupying a portion of the superior and anterior mediastina. It grows until the end of the second year, after which it diminishes, and almost entirely disappears. It has a large lymphatic vessel, which has been supposed to be an excretory duct. Its structure is lobulated, and surrounded by loose cellular tissue. Each lobule contains several membranous cells or vesicles, which contain a white fluid and open into a central cavity or reservoir. The fluid contains corpuscles resembling the white blood corpuscle and the chyle corpuscle.

### PERICARDIUM.

The pericardium is a membranous sac, in which the heart is contained. It consists of two layers, the external of which is fibrous, dense, and white, and the internal is serous. The serous lamina lines the fibrous layer, and then is reflected over the heart and the roots of its vessels.

### THE HEART.

The heart is a hollow muscular organ, surrounded by a membranous sac called the pericardium. It is situated between the two pleuræ, and rests upon the cordiform tendon of the diaphragm, in the cavity of the thorax.

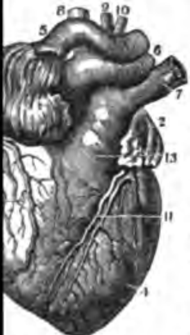
Its *shape* is conoidal, though it is somewhat flattened upon that side which rests upon the tendon of the diaphragm. Its apex inclines to the left side, touching the walls of the thorax, between the fifth and sixth ribs. It *measures* five inches and a half from its apex to its base, three inches and a half in the diameter of its base, and *weighs* about six or eight ounces. It contains *four cavities,* which perform two functions, that of receiving the blood and throwing it into the lungs, and that of receiving it again after it has been oxygenated, and distributing it throughout the body. The receptacles are les, and the *ventricles propel* the blood to the lungs and through ystem.

e auricle and ventricle of the *right side* receive and propel the s blood into the lungs. The auricle and ventricle of the *left* eceive and propel the arterial blood throughout the body.

e *circulation* of the blood is as follows: the ascending and deing vena cava empty the venous blood into the right auricle; here it passes to the right ventricle, through an opening prol by a valve opening downwards; from the right ventricle it opelled through the pulmonary artery, which divides into oranches, to the lungs; after it has been subjected to the ine of the respiratory process, it is brought from the lungs, by oulmonary veins, into the left auricle. The left auricle has an ng into the left ventricle, protected by a valve opening down, and from the left ventricle it passes into the aorta, thence to tributed throughout the body.

e *right auricle*[1] is an irregularly-shaped cavity, somewhat obnd cuboidal; anteriorly it has a convexity which is called its ; superiorly there is an elongated process resembling the ear of nimal, whence the term auricle. Its walls are thin, and comof muscular fibres, which from their parallel arrangement ree the teeth of a comb, and hence are called *musculi pectinati.* uperior[5] and inferior vena cavæ enter the auricle from behind, etween their orifices there is an elevation, called *tuberculum ri.* On the septum or partition between the auricles, is a deon called *fossa ovalis*, where formerly existed the foramen of fœtal life; the ring or edge surrounding it, is called the *is ovalis*, from which there extends downwards to the inferior ircumference of the ascending cava, a crescentic doubling of ning membrane, which is the remains of the *Eustachian* valve.

Fig. 114.



The *coronary* veins open into this cavity, and their orifice is protected by the *valve of Thebesius.* The opening to the ventricle, called the *ostium venosum*, is circular and surrounded by a dense white line.

The *right ventricle*[3] is a triangular cavity, with thick walls, and of greater capacity than any other cavity of the heart. Its muscular structure is in the form of large fleshy bundles, called *columnæ carneæ*, from which proceed thin, white cords, called *chordæ tendineæ*, which are attached to the edge of the *tricuspid valve.* The tricuspid valve is circular, and its upper edge is attached to the tendinous line of the ostium venosum; its lower edge has three spear-

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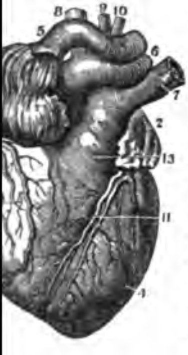

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The *left auricle*[2] is more concealed in its natural position than the right. Into it enter four pulmonary veins, which give it a quadrangular shape. Its walls are muscular, and somewhat thicker than those of the right auricle. In its ear-like appendage the muscular fibres are arranged as *musculi pectinati;* the opening, by means of which it communicates with the left ventricle, is called *ostium venosum*, and surrounded by a white tendinous ring. The septum between the auricles is not always perfect even in adult life.

The *left ventricle*.[4]—This cavity forms the apex of the heart; it is conoidal in its shape. Its walls are thick, and its *columnæ carneæ* numerous, strong, and projecting; the *chordæ tendineæ* are well developed, and attached to the *bicuspid* or *mitral valve*. This valve consists of but two leaflets, one of which is much larger than the other; its base is attached to the ring surrounding the ostium venosum, and its edge opens downwards into the left ventricle: hence the contraction of the ventricle closes this opening, and the blood passes out by the *aorta*,[6] at whose orifice there are three *semilunar* or *sigmoid* valves, each having a corpuscle of Arantius in its edge, and *sinuses* of Valsalva or Morgagni behind them. The vessels supplying the heart with blood are the right and left coronary arteries;[11] [12] the veins which accompany them empty by a common trunk into the right auricle. The nerves are derived from the cardiac plexuses of the sympathetic.

# SECTION V.

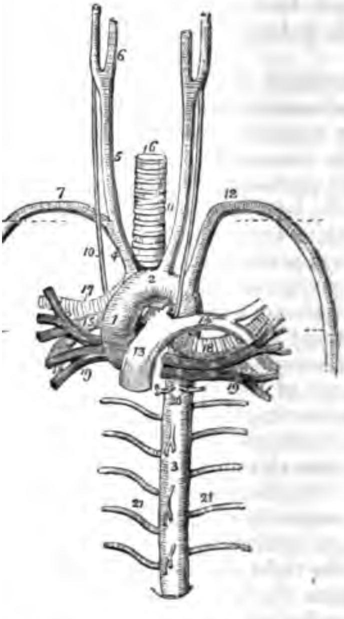
## VESSELS.

### STRUCTURE OF ARTERIES.

*ries* are composed of three coats; external, middle, and in-

*external* is firm and strong, formed of condensed cellular tissue; it does not yield upon the application of a ligature.

Fig. 115.



*The middle* is formed of elastic, fibrous tissue, and was formerly called the muscular coat. It is thick, and its fibres are arranged circularly; in which direction they readily yield to a ligature. It contains a few involuntary muscular fibres.

*The internal* is a thin, serous covering, which diminishes the friction of the passage of the blood. It is smooth and transparent, and readily torn.

*Arteries* convey blood *from* the heart, and *veins* carry blood *to* the heart; thus, the pulmonary artery conveys blue or what is usually called venous blood, and the pulmonary veins convey red or what is termed arterial blood.

nutritious vessels of the arteries are called *vasa vasorum*, and erves are derived from the sympathetic.

### AORTA.

aorta arises from the left ventricle opposite the articu fourth costal cartilage with the sternum. At first it a ight, then curves backwards and to the left, and desce side of the vertebral column to the fourth lumbar ve

The *ascending aorta* is partially covered in front and at its origin by the pulmonary artery. The upper edge of the *arch* is on a level with the second dorsal vertebra, and under it passes the right pulmonary artery. It is frequently enlarged into a *sinus* in old persons. The descending aorta[3] while passing through the thorax is termed *thoracic*, and while passing through the abdomen, *abdominal*.

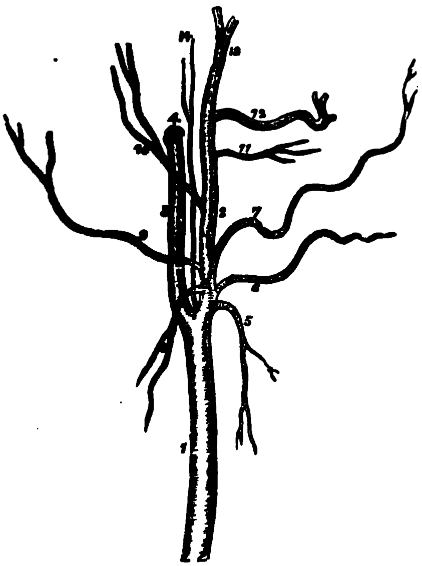
*The coronary* arteries are the first branches of the aorta, and are distributed to the heart, through the grooves between the auricles and ventricles. They arise just beyond the semilunar valves.

*The Innominata.*[4]—This artery arises from the arch of the aorta, is an inch and a half in length, ascends obliquely towards the right side in front of the trachea, and behind the transverse vein. Opposite the sterno-clavicular articulation, it divides into the right carotid and right subclavian. (Fig. 115.)

*The right carotid*[9] arises from the innominata, and ascends the neck as far nearly as the hyoid bone, where it divides into the external and internal carotids.

*The left carotid*[11] arises from the arch of the aorta, ascends obliquely through the thorax until it reaches the neck, and then it is distributed as the right. Each primitive carotid is on the inner side of the internal jugular vein, with which and the par vagum nerve it is included in a sheath. (Fig. 115.)

Fig. 116.



### EXTERNAL CAROTID.

(Fig. 116.)

It ascends perpendicularly from the bifurcation of the carotid, and passing through the deep portion of the parotid gland it divides into the *internal maxillary*[12] and *temporal.*[13]

*Superior thyroid,*[5] arises near the root of the external carotid and is its first branch; it pursues a curved course downwards and is distributed to the thyroid gland, after giving off a *laryngeal branch.* (Fig. 116.)

*ual,*[6] ascends obliquely from its origin, which is just above
erior thyroid. It penetrates the hyoglossus muscle just
he cornu of the hyoid bone, and then courses between the
of the tongue, giving off the dorsalis linguæ, sublingual and
ranches. The ranine reaches the tip of the tongue.

*al.*[7]—This arises above the lingual, is tortuous, becomes im-
in the submaxillary gland, and then passes over the lower
front of the insertion of the masseter muscle, and gives off
branches to the face.

*mental,* arises from the last, and supplies the chin.

*eteric,* also arises from the facial, and is distributed to the
r muscle.

*ior labial,* is spent upon the integuments and muscles be-
he chin and the lip.

*rior and inferior coronary,* surround the lips and mouth.
nainder of the facial artery is distributed by a branch upon
of the nose and one to the inner angle of the eye, where it
ioses with the ophthalmic.

*ior pharyngeal,*[14] arises near the bifurcation of the carotid,
the external carotid, and is distributed to the pharynx. It
ives off the *posterior meningeal,* which enters the cranium
the *posterior foramen lacerum.*

*oid.*[8]—This branch is irregular and uncertain in its origin,
plies the muscles and glands of the neck.

*pital,*[9] arises from the external carotid a little below the
orming a loop with the hypoglossal nerve; it is distributed
e muscles and integuments upon the back of the head, anas-
g with the temporal and its fellow.

*rior auricular,*[10] arises from the external carotid, ascends
ly backwards, beneath the parotid gland, and passing between
ernal meatus and mastoid process, is distributed upon the in-
nts. A branch of it, called *stylo-mastoid,* enters the stylo-
l foramen.

*sversalis faciei,*[11] arises from the carotid, and crossing the
r muscle parallel with the duct of Steno, is distributed upon
.

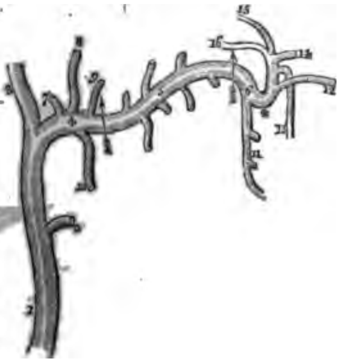
*anterior, posterior, and middle temporal* are the terminating
s of the temporal artery. The *anterior* is distributed upon
ple and side of the head. The *posterior* is distributed upon
guments on the back of the head. The *middle* perforates
poral fascia and supplies the temporal muscle.

## INTERNAL MAXILLARY.

[12] commences at the bifurcation of the external caroti
s a very tortuous course, supplying the back portion

mouth and palate. At first it is horizontal, then ascending, it terminates in a horizontal course. Its branches are numerous, and are as follow: (Fig. 117.)

Fig. 117.



*Tympanic*,[7] is distributed to the tympanum through the Glaserian fissure.

*Meningea magna*,[8] passes through the foramen spinale and becomes the middle artery of the dura mater.

*Meningea parva*,[9] arises from the last or near to it, and is also distributed to the dura mater, having entered the cranium through the foramen ovale.

*Inferior dental*,[10] descends to the posterior mental foramen, and supplies the teeth of the lower jaw, then emerging at the anterior mental foramen, anastomoses with the facial.

*Deep temporal.*—These are two branches distributed to the temporal muscles.

*Pterygoid and Buccal.*—These are muscular branches supplying the muscles and the lining of the cheek.

*Superior dental, or alveolar, or maxillary*,[11] descends, and winding round the tuberosity of the upper jaw, gives off branches to the molar teeth, antrum, and gums.

*Infra-orbital*,[12] enters the orbit of the eye, and passes along the infra-orbital canal; it sends branches to the teeth and integuments of the face.

*Superior palatine*,[13] passes through the posterior palatine foramen, and supplies the mouth and palate.

*Superior pharyngeal*,[15] supplies the upper part of the pharynx and the Eustachian tube; from it arises the *vidian*.[16]

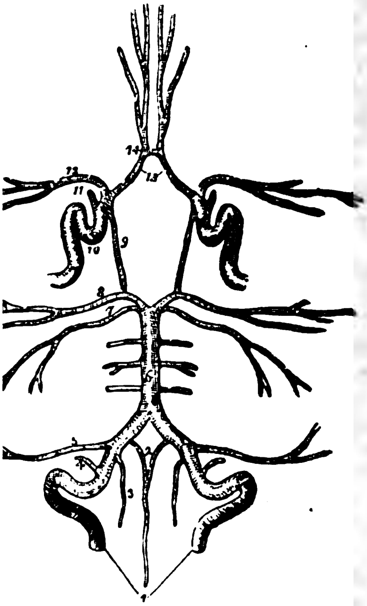
*Spheno-palatine*,[14] enters the nose through the spheno-palatine foramen, and is distributed by branches to the mucous membrane of the nose.

## ARTERIES OF THE BRAIN.

The arteries at the base of the brain are derived from the vertebrals and internal carotids. (Fig. 118.)

The *vertebral* arteries[1] enter the cavity of the cranium through the foramen magnum occipitis, and coalescing, form a thick trunk called the *basilar*.[6] Previous to their union are given off the *anterior*[2] and *posterior*[3] spinal arteries. The *inferior cerebellar* arises from the vertebral also. The basilar pursues its course along the median line of the pons varolii, giving off several branches in its

Fig. 118.



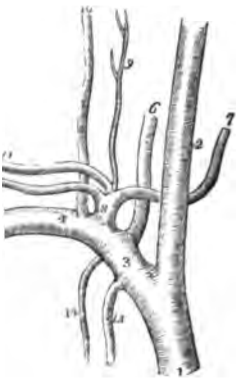
course. The principal being the *superior cerebellar*[7] and the *posterior cerebral* arteries.[8]

The *posterior communicating*[9] joins the carotid[10] with the posterior cerebral.

From the carotid, which enters through the carotid canal, are given off the *ophthalmic*,[11] *middle cerebral*,[12] and *anterior cerebral arteries*.[13] The two anterior cerebral arteries are connected by a transverse branch[14] called the *anterior communicating* artery, and thus is formed the circle of Willis. These vessels are distributed to the *pia mater*, and the substance of the brain.

*subclavian*[3] of the right side arises from the innominata,[11] and the subclavian of the left side from the arch of the aorta. The right is shorter and more superficial than the left. The subclavian emerges from the thorax by passing over the first rib between the anterior and middle scaleni muscles. Its branches are numerous, and vary in their mode of origin. Some arise by a common origin,[8] called the *thyroid axis*.

Fig. 119.



*Vertebral*,[6] is the first and largest branch of the subclavian. It passes through the foramina of the
verse processes of the six s
cervical vertebræ, and ent
cavity of the cranium thro
foramen magnum occipitis.

*Inferior thyroid*,[7] arises from the thyroid axis or the subclavian, and curves forwards and upwards behind the great vessels of the neck to supply the thyroid gland, giving off the *ascending* or *superficial cervical*.[8]

*Superior intercostal*,[14] arises from the subclavian, and descending, supplies the two upper intercostal spaces. It frequently gives off the *profunda cervicis*.[10]

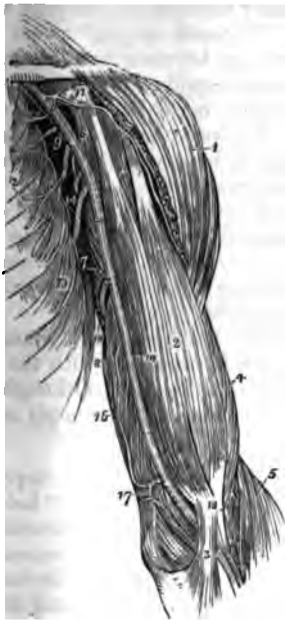
*Internal mammary*,[9] is larger than the last, and entering the cavity of the thorax, descends within a few lines of the sternum, giving off branches to the diaphragm, thorax, and abdomen.

*Posterior or transverse cervical*,[11] arises from the subclavian in an irregular manner, and winds round the root of the neck, in front of the brachial plexus and scalenus anticus muscle, until it reaches the base of the scapula, along which it descends, and supplies the muscles upon the back. The subclavian artery, passing under the subclavius muscle, is afterwards called *axillary*.

*Profunda cervicis*,[10] arises from the subclavian or the superior intercostal. It ascends the back of the neck between the complexus and semi-spinalis colli muscles.

*Supra-scapular*, or transversalis humeri.[12]—This usually arises from the thyroid axis, but sometimes from the axillary. It passes over the scapula, and supplies the muscles upon its dorsum, sending a small branch through the coracoid notch.

Fig. 120.



### AXILLARY.

This artery may also be considered as extending from the lower edge of the subclavius muscle to the lower margin of the tendon of the latissimus dorsi.

*External mammaries*.—Usually are four in number, arising singly or together, from the axillary. They are the *acromial thoracic*,[11] distributed upon the shoulder, and sending a branch between the pectoralis major and deltoid muscles; *superior* and *inferior thoracic*,[13] which are distributed upon the *pectoralis* and the *serratus magnus muscles;* and the *y thoracic*, which is distributed to the fat and glands of the

*ular.*[14]—This is the largest branch of the axillary; it passes he external edge of the scapula, and gives off a large branch, *lorsalis scapulæ*, which anastomoses with the supra-scapular, dorsum of the scapula.

*rior and Posterior Circumflex*, arise from the axillary, opposite neck of the humerus. The anterior is small, and supplies nt of the joint; the posterior is large, and passes backwards, ng the joint and deltoid muscle. Sometimes it arises from *funda major.*

## BRACHIAL.

*brachial* artery extends from the axilla to the elbow joint, ling upon the inner edge of the coraco-brachialis and biceps uscles, in company with the median nerve. (Fig. 120.)

*unda major*,[15] arises from the brachial at its upper part, and between two heads of the triceps muscle, with the spiral supplies the external portion of the arm, and at the external inosculates with the radial recurrent.

*unda minor*,[16] is small, arises below the last, is distributed ially about the internal condyle, and anastomoses with the ecurrent.[18]

*itious* artery, arises opposite the nutritious foramen of the s, which it enters to supply the bone.

*tomotic*,[17] arises from the brachial just above the elbow, and round the internal condyle, anastomoses with the ulnar nt. (Fig. 121.)

brachial, passing under that portion of the brachial fascia s connected with the tendon of the biceps, divides into the and *ulnar*, although this division may take place at any etween the arm-pit and elbow.

## RADIAL.

*radial*[12] is more superficial than the ulnar. It descends the ide of the arm,[12] between the tendons of the supinator radii and flexor carpii radialis.

*ial recurrent*,[13] arises from the radial and inosculates with funda major. In its descent, the radial gives off numerous ar branches, until it reaches the wrist, it then passes backnder the extensor tendons of the thumb.

*rficialis volæ*,[14] is given off from the radial, and distributed e palmar surface of the thumb, joining the superficial arch.

*alis carpi*, arising from the radial, is distributed up the wrist beneath the extensor tendons.

*na pollicis*, one of the terminating branches of the ng the thumb.

*Radialis indicis*,[17] arises in connexion with the last, and is distributed upon the radial side of the forefinger.

*Palmaris profunda*, or *deep arch*, another terminating branch of the radial, which passes between the flexor tendons and bones of the metacarpus, to join the cubitalis manus of the ulnar.

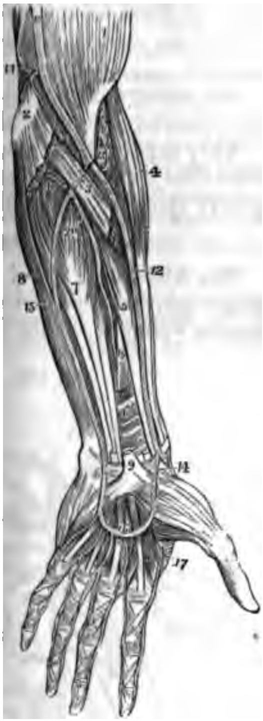
ULNAR.

It passes[18] under the bellies of several superficial muscles arising from the internal condyle, and descends the inner side of the arm, between the tendons of the flexor carpi ulnaris and flexor sublimis muscles; then passes over the annular ligament of the wrist, to form the superficial arch. (Fig. 121.)

*Ulnar recurrent*,[18] arises from the ulnar near its commencement, and then winding under the internal condyle, anastomoses with the anastomotic.

*Interosseous*,[19] arises from the ulnar opposite the tubercle of the radius, and divides into an anterior and posterior branch; the anterior interosseous descending to the wrist in front of the interosseous ligament; the posterior perforates the ligament, and is distributed to the extensor muscles of the arm.

Fig. 121.



*Dorsalis manus*, arises from the ulnar, and is distributed upon the back of the hand.

*Superficial arch*,[19] is a continuation of the ulnar artery, immediately beneath the palmar fascia.

*Cubitalis manus profunda*, a branch of the ulnar, arising near the superficial arch; it joins the deep arch.

*Digital arteries.*—These are three in number, and arise from the superficial arch. At the metacarpo-phalangeal articulation, they divide into the digito-radial and digito-ulnar, for each side of the finger. The ulnar side of the little finger is supplied by a distinct branch from the superficial arch.

THORACIC AORTA.

The Thoracic Aorta descends upon the left side of the vertebral column through the posterior mediastinum.

*Bronchial*,[20] *vary in size* and origin. Sometimes arising by a n trunk from the arch of the Aorta. They enter the root of ng, and supply its parenchymatous structure, glands, &c. 15.)

phageal,[3] are from four to six in number, arising from the r convexity of the aorta, to be distributed to the œsophagus.

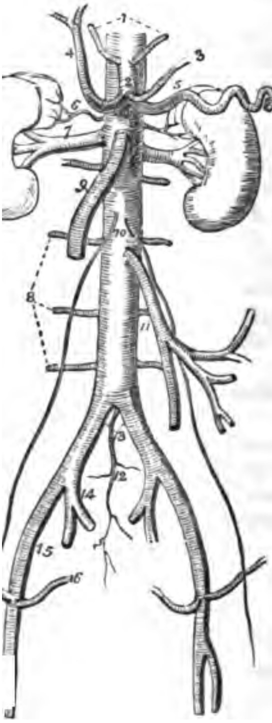
costal.[21]—These are ten in number on each side, arising from terior convexity of the aorta.

supply the ten inferior intercostal spaces, the right being hat longer than the left. They are received in the intercostal upon the under edge of each rib, for two-thirds of its length.

## ABDOMINAL AORTA.

Abdominal Aorta commences at the hiatus aorticus of the gm and terminates at the junction of the fourth and fifth vertebræ, in the iliacs and middle sacral.

Fig: 122.



*Phrenic.*[1]—These are two in number, one for each side of the diaphragm, to which they are distributed; sometimes they arise by a common trunk from the cœliac.

*Cœliac axis.*[2]—A short, thick trunk about half an inch in length, given off opposite the junction of the last dorsal and first lumbar vertebræ; it divides into the gastric, hepatic, and splenic.

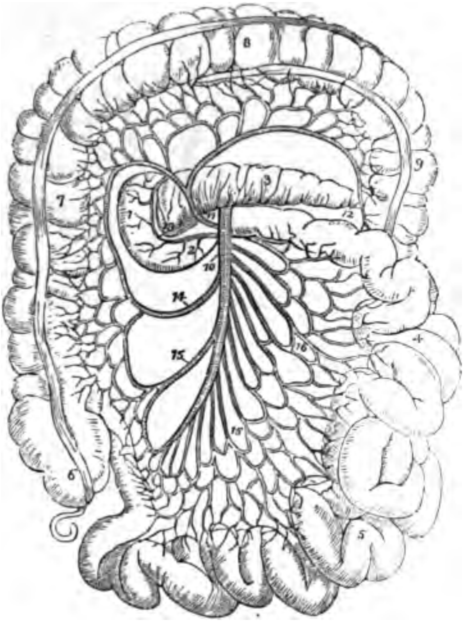
*Gastric,*[3] is the smallest branch of the cœliac, and supplies the lesser curvature of the stomach.

Hepatic,[4] enters the transverse fissure of the liver, and divides into two or three branches, before entering the substance of the liver. It gives off the *cystic,* which supplies the gall-bladder and th *gastro-epiploic,* supplies the right the greater curva the stomach.

*Splenic.*—This is the largest branch of the cœliac. It is very tortuous, and passes transversely to the spleen over the upper edge of the pancreas; from it are given off the *vasa brevia* and *left gastro-epiploic arteries*, supplying the left extremity and left side of the greater curvature.

*Superior mesenteric,*[9] arises immediately below the cœliac and is nearly as large. It passes beneath the pancreas and over the duodenum, and descending towards the right side it forms a curvature, the convexity of which is to the left. (Fig. 123.) From it are given sixteen or twenty large branches, which form an arch;[16] from this arch are given off secondary branches to form a second arch, and from this a third is formed. From this last arch the branches are derived which supply the small intestines. From the superior mesenterics are also given off three branches to the right side of the large intestine: *ileo-colica*[15] supplying the cæcum and a portion of the ileum; *colica dextra* supplying the ascending colon, and *colica media*[11] supplying the arch of the colon.

Fig. 123.

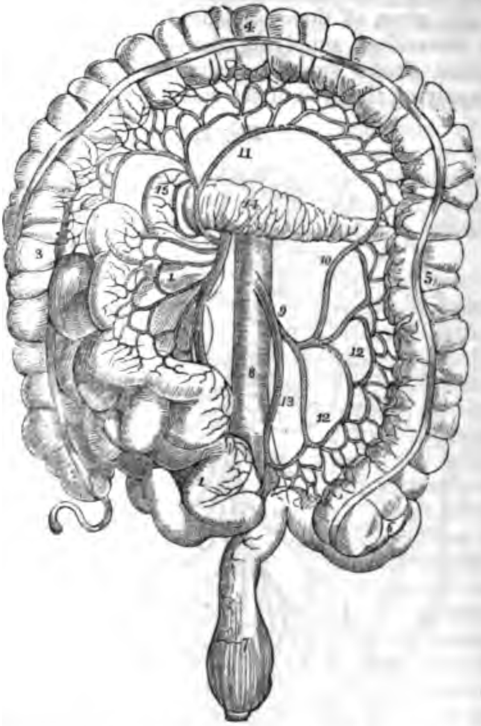


*Capsular,*[6] arise from the aorta or renal, and supply the supra-renal capsules. (Fig. 122.)

*al or Emulgent.*[17]—These are of large diameter, though not ng. They pass transversely to the kidney, and divide into branches before entering it. The right is longer and more in its course than the left, and is partly concealed by the ing vena cava. (Fig. 122.)

*matic.*[10]—These are about the size of a large knitting-needle, from the aorta and sometimes from the renal. They are is in their course and pass through the abdominal rings; after they divide into several branches before reaching the testicles. he female, they are distributed to the ovaries.

Fig. 124.



*ior mesenteric,*[11] arises from the aorta an inch above its (Fig. 124.) It is about the size of a goose-quill, and *superior left colic,*[11] ***middle left colic,***[12] ***and inferior l*** , which supply the descending colon, and also the *hoidal,*[13] which is distributed to the upper part of the

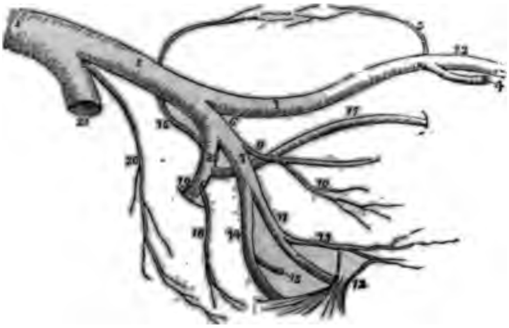
*Lumbar.*[8] (Fig. 122.) Arise on each side of the aorta, and are four or five in number; they correspond with the intercostals of the chest, and supply the muscles of the loins and abdomen.

*Middle sacral.*[20]—Is the termination of the aorta arising at its bifurcation into the iliacs. It descends along the median line of the sacrum.

### COMMON ILIAC.

The aorta[1] divides into the *iliacs* at the lower part of the fourth lumbar vertebra. The iliac[2] descends obliquely outwards to the sacro-iliac articulation, being crossed by the ureter, and divides into the *external*[3] and *internal iliac.*[6]

Fig. 125.



INTERNAL ILIAC.

This is a short trunk,[6] descending in front of the sacro-iliac junction into the cavity of the pelvis, and giving off numerous branches with great irregularity and variety from its two principal trunks, the *gluteal*[8] and *ischiatic.*[7] (Fig. 125.)

*Ilio-lumbar.*[16]—Arises from the internal iliac or one of its principal trunks, ascends outwardly toward the crest of the ilium, and is spent upon the loins, anastomosing with the circumflex ilii.

*Obturator.*[17]—May arise at various parts of the internal iliac, and passing forwards below the brim of the pelvis, escapes from it at the upper part of the thyroid foramen; it is distributed by two branches upon the obturator and adductor muscles. Sometimes it arises from the epigastric.

*Lateral sacral.*[18]—This artery sends four branches through the anterior sacral foramina, anastomosing with the middle sacral.[20]

*Gluteal.*[8]—Is a continuation of the posterior trunk. It passes out of the pelvis at the upper part of the sacro-sciatic notch above the pyriformis muscle, and is distributed by two or three branches to the glutei *muscles.*

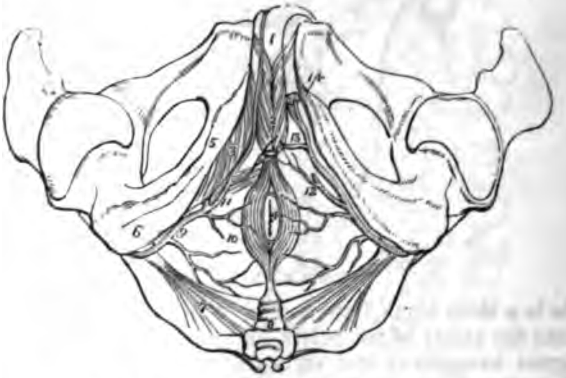
*al.*[10]—Arises from the remains of the *umbilical,*[9] or from ernal iliac, and is spent upon the bladder. There is somen inferior vesical.[15]

*lle hemorrhoidal.*[13]—Is of variable size and origin. It is ited to the rectum, vesiculæ seminales, and prostate gland.

*atic.*[14]—Is the anterior of the two principal trunks of the l iliac. It passes out of the pelvis through the sciatic notch, ı the pyriformis muscle and great sacro-sciatic ligament. lies the muscles on the floor of the pelvis and back of the

*nal pudic.*[11]—Arises from the last, previous to its emergence e pelvis. It also escapes from the pelvis, and returns bethe sciatic ligaments; ascending upon the ramus of the ı and pubes, it supplies the penis and perineum. (Fig. 126.)

Fig. 126.



*r hemorrhoidal.*[10]—Arises from the internal pudic,[9] and is ited upon the anus and rectum. There are sometimes two

*sverse perineal.*[11] [12]—Arises near the crus of the penis, and ross the transverse perineal muscles. It is cut in the lateral n for stone.

*hro-bulbar.*[13]—Is given off from the pudic near its perforation riangular ligament, and enters the corpus spongiosum, which ies.

*alis Penis.*—Ascends until it gets under the arch and then runs along the back of the penis.

*rnous.*[14]—Another terminal branch which enters the sum.

## EXTERNAL ILIAC.

This artery[3] extends (Fig. 125) from the sacro-iliac junction along the inner border of the psoas magnus muscle to the crural arch; when it passes under Poupart's ligament it becomes the *femoral.*[22]

*Epigastric.*[4]—Arises from the external iliac just behind Poupart's ligament, and ascends obliquely upwards and inwards, in the transversalis fascia, and between the two abdominal rings, whereby it is endangered in the operation for hernia. A branch of it supplies the cremaster muscle.

*Circumflex ilii,*[5] arises from the external iliac opposite the epigastric, and ascends obliquely until it reaches the crest of the ilium, where it divides and supplies the muscles of the loins and abdomen. The last two arteries anastomose freely with the internal mammary and lumbar arteries.

## FEMORAL.

This artery commences at Poupart's ligament, being a continuation of the external iliac. It passes spirally down the inner side of the thigh, and perforating the tendon of the adductor magnus muscle, becomes the *popliteal.* Its upper third is superficial, and upon the outer side of the femoral vein. Its lower two-thirds are covered by the sartorius muscle.

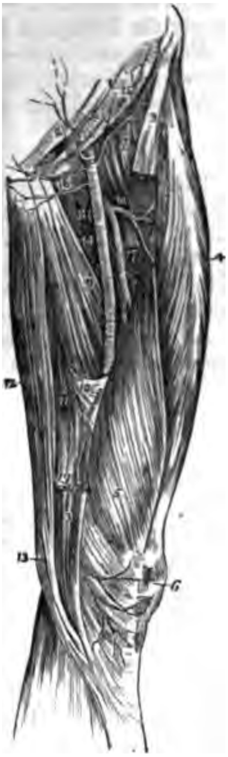
*Superficial artery of the abdomen,*[2] arises from the femoral, just below Poupart's ligament, and ascends obliquely upon the integuments on the lower portion of the abdomen. It may be cut in the operation for inguinal hernia.

*External pudics.*[15] [16]—These are several branches, arising from the upper part of the femoral, and distributed to the integuments and glands of the groin.

*Profunda,*[17] is almost as large as the femoral, from which it arises at about two inches below Poupart's ligament. It passes downwards and backwards between the adductor brevis and vastus internus muscles.

*External circumflex*[23] is a branch of the profunda, and passes outwards between the rectus and cruræus, to supply the upper part of the muscles of the thigh.

Fig. 127.



*nal circumflex*[8] is larger than the external, and supplies the
upon the inner side of the thigh, and gives off a *perfo-*
rtery. The *perforating* arteries are branches of the inter-
umflex and profunda, which perforate the adductor magnus,
ply the muscles upon the back of the thigh.
*tomotic,*[19] [6] arises from the femoral above its perforation of
luctor magnus tendon, and anastomoses with the articular
of the knee.

## POPLITEAL.

artery is a continuation of the femoral, and extends from
foration in the adductor tendon, to its division into the ante-
l posterior tibial below the knee. (Fig. 129.)
*rior articular.*[9]—These are two in number, one internal and
ernal, given off above the condyles, anastomosing with each
d the anastomotic artery.
*ior articular.*—These are also external and internal, and
the knee-joint below the head of the tibia.
*lle articular.*—Is small, and perforates the ligament of
w, to supply the interior of the joint.
*ellar.*—These supply the heads of the gastrocnemius muscle.

## POSTERIOR TIBIAL.

artery[11] [12] descends the back of the leg, under the muscles
orm its calf, and nearer to the tibia than the fibula. (Fig.

*neal* or *fibular,*[13] [14] arises from the posterior tibial, and di-
to several branches, which are distributed upon the muscles
from the fibula.
he posterior tibial approaches the ankle, it passes between
rnal malleolus and the tendo Achillis into the sinuosity of
alcis.

## ANTERIOR TIBIAL.

artery[10] (Fig. 129) perforates the interosseous membrane,
pper part, and descends in front of it to the ankle. Its
third[9] is situated between the tibialis anticus and extensor
digitorum muscles; below, it runs between the tibialis an-
nd extensor proprius pollicis. In its course it gives off
us muscular branches, and when it reaches the ankle
s more superficial, being covered by the tendons upon the

*rrent tibial,*[10] ascends beneath the tibialis anticus, and
s with the articular arteries of the knee-joint.
*nal malleolar.*[11]—Arises from the anterior tibial abo
oint, and is distributed upon its inner side.

*External malleolar.*[17]—Arises below the last, and is distributed upon the outside of the ankle.

*Tarsal.*[8]—Arises from the anterior tibial, and arches transversely across the tarsus, beneath the extensor brevis digitorum muscle.

*Metatarsal.*[14]—Arches across the bases of the metatarsal bones, and gives off three interosseal branches, which supply the toes.

Fig. 128.

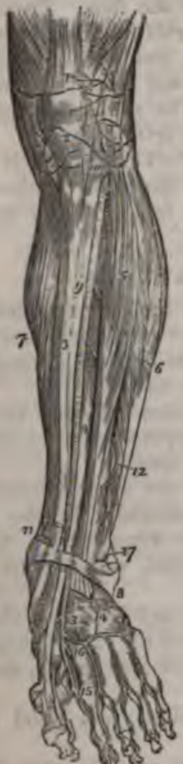
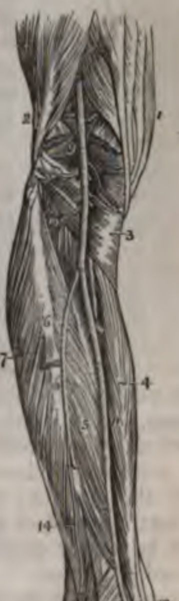


Fig. 129.

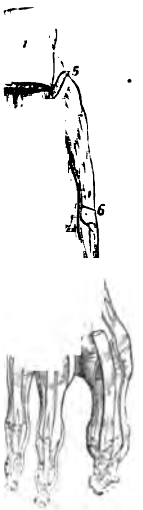


*Dorsalis hallucis.*[15]—Is the terminating branch of the anterior tibial, and supplies the outer side of the great toe and the inside of the second toe.

*Pedal.*[16]—This branch forms the communication between the anterior tibial and external plantar arteries. It descends to the sole of the foot, through the first interosseous muscle.

### PLANTAR.

Fig. 130.



These arteries (Fig. 130) are two in number, and are branches of the posterior tibial, which reaches the sole of the foot through the sinuosity of the os calcis.

*External plantar.*[7]—This is the larger of the two, and passing obliquely outwards upon the sole of the foot, it forms a deep arch[8] above the muscles of the foot. From it are given off digital arteries for the supply of the interosseous spaces, and which, bifurcating into the external and internal branches, supply the toes. The external plantar terminates in the pedal artery.

*Internal plantar.*[6]—This is a small artery, which passes along the inner border of the foot, and terminates in the digital artery of the great toe.

### VEINS.

The veins return the blood to the heart. They are much more numerous than the arteries, and differ from them in having valves opening towards the heart.

e valves are formed of two or three crescentic folds of the lining ane, and give the veins a knotty appearance when injected. re more numerous in the superficial vessels.

veins have three coats, but they are much thinner than of the arteries; this deficiency, particularly in the middle coat, gives them a flaccid appearance when empty, whereby n be readily distinguished from arteries, which retain their ical character.

*superficial* veins are more tortuous and irregular than the The *deep* accompany all the arteries, with the exception of those largest class. There are two veins for each artery, and they led *venæ comites,* or *satellites.*

*uses* are channels conveying venous blood, and lined by the l coat of the veins.

distribution and anastomoses of the veins are much more ar than those of the arteries.

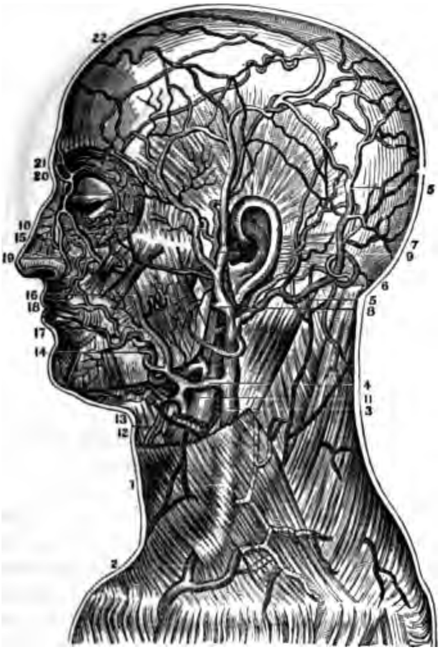
### VEINS OF THE HEAD AND NECK.

venous blood from the face is for the most part ccompanying the arteries, and which have the sa principal trunks, viz., the *temporal, internal ma* *occipital,* join to form a superficial vein of the neck, called *external jugular.*

*External jugular.*[3]—Receives the blood from the temporal,[8] occipital,[5] and internal maxillary. It commences at the lower edge of the parotid gland, and descends the neck superficially, being merely covered by the skin, platysma myoides muscle, and superficial fascia. Its course is towards the middle of the clavicle. It crosses obliquely the sterno-cleido-mastoid muscle, and empties into the subclavian, outside of the origin of this muscle. It is frequently selected for bleeding in children.

*Internal jugular.*[11]—This vein is the largest of the neck. It receives the blood from the lateral sinus of the dura mater, and also from some superficial veins.

Fig. 131.



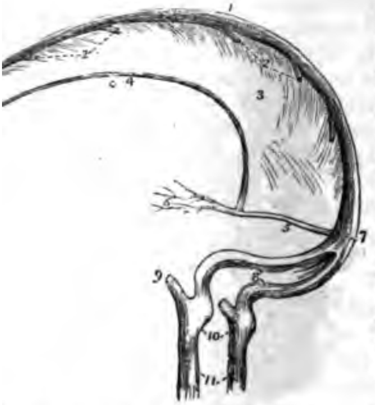
The facial vein[16] empties into the internal jugular, and also forms a communication[4] between it and the external jugular. The internal jugular descends the neck in a sheath with the carotid artery, being on the outer side. The par vagum nerve is in the same sheath and between the vessels. This vein empties into the subclavian on the inner side of the origin of the sterno-cleido-mastoid muscle. This junction forms the *vena innominata.*

## SINUSES OF THE DURA MATER.

These are channels between the laminæ of the dura mater, which remove the blood from the brain. (Fig. 133.)

*Superior longitudinal sinus.*[1]—This is a triangular channel, commencing at the foramen cæcum by a small vein from the nose, and gradually increasing in size by the junction in an oblique manner, of the veins of the pia mater.[2] It forms an arch in the median line of the vault of the cranium, which terminates at the internal occipital cross in an enlargement called *Torcular Herophili.*[7]

Fig. 132.

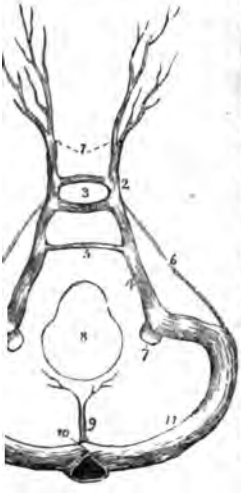


*Inferior longitudinal sinus.*[4]—This is situated in the inferior margin of the falx cerebri; it empties into the straight sinus at the interior edge of the tentorium.

*Straight,* or *Fourth sinus.*[5]—It reaches from the junction of the inferior longitudinal sinus to the torcular Herophili, in the median line of the tentorium, where it is joined by the falx cerebri.

*Venæ Galeni.*[6]—These veins are in the velum situm; they frequently unite into a trunk called *vena azygos,* entering the straight sinus.

Fig. 133.



*Lateral sinuses.*[11] — These commence at the torcular Herophili, are oval-shaped channels, and pursue a curved course over the occipital, parietal, and temporal bones, until they reach the posterior foramen lacerum, where they emerge, and form the commencement of the internal jugular vein.[7] In their course they receive blood from several other sinuses. (Fig. 133.)

*Cavernous sinuses,*[2] are venous cells on either side of the *sella turcica,* containing a spongy structure; into them empty the ophthalmic veins,[1] and through them pass the internal carotid artery and the sixth nerve.

*Circular sinus.*[3]—It surrounds the pituitary gland in the *sella turcica,* and communicates upon each side with the cavernous sinus.

*Superior petrosal sinus.*[6]— a small sinus, running along petrous portion of the temporal bone, and reaches ous to the lateral sinus.

*rior petrosal sinus.*[4]—Extends from the cavernous each side, along the inferior margin of the petrous portion of the temporal bone, and opens into the lateral sinus near its exit from the cranium.

*Anterior occipital sinus.*[8]—It passes transversely across the basilar process of the occipital bone, connecting the two inferior petrosal sinuses.

*Posterior occipital sinus.*[9]—This is in the inferior edge of the falx cerebelli, descending from the torcular Herophili; when it reaches the foramen magnum, it bifurcates and empties into the lateral sinus upon each side. This communication is not represented in the diagram.

The venous blood from the channels in the diploic structure empties into the sinuses at the base of the cranium.

*Emissaries of Santorini*, are small veins passing through minute foramina of the bones of the cranium and forming a communication between the vessels of the scalp and the sinuses of the brain.

## VEINS OF THE UPPER EXTREMITY.

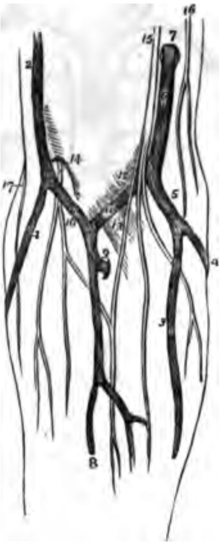
The superficial veins of the upper extremity are readily seen beneath the skin; the *deep veins* have the usual arrangement of the *venæ comites.* The *superficial veins* are the following:

*Cephalic.*[2]—This originates upon the thumb by a branch called *cephalica pollicis*, and also upon the back of the hand; ascending upon the radial side[1] of the fore-arm, it is joined at the elbow by the *median* cephalic. It pursues its course along the outer side of the biceps, and entering a fissure between the *pectoralis major* and *deltoid* muscle, it empties into the subclavian vein under the clavicle. It sometimes communicates with the external jugular.

*Basilic,*[7] commences with the *vena salvatella* of the little finger, and receiving large branches[3 4] upon the ulnar side of the fore-arm, it is joined at the elbow by the median basilic. It then ascends the arm along the inner edge of the biceps muscle, and about its middle it joins the venæ comites to form the *axillary* vein.

*Median.*[8]—This collects the blood from the anterior face of the fore-arm, and near the elbow communicates[9] with the deep veins. It afterwards divides into the *median basilic*[11] and *median cephalic.*[10] The latter is the smaller of the two, and under it pass

Fig. 134.



s of the external cutaneous nerve.[14] A branch of the in-
utaneous nerve[12] [13] passes over the median basilic, and may
in bleeding.

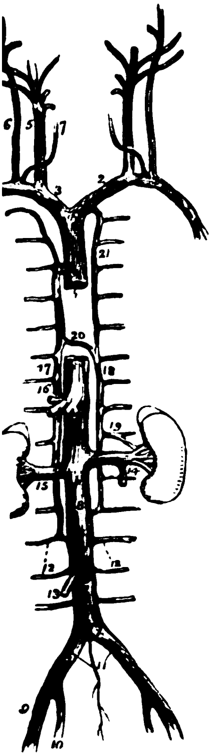
*lary.*—It is formed by the junction of the basilic with the
omites of the brachial artery. It lies in front of the artery,
the subclavius muscle terminates in the subclavian vein.

*lavian.*—This is a continuation of the axillary. It passes
he clavicle and over the first rib to join the internal jugular
m the vena innominata. It lies in front of the artery, and
ated from it while passing over the first rib by the scalenus
muscle.

## SUPERIOR OR DESCENDING VENA CAVA.

veins which form the descending cava[1] are the right and left venæ innominata.

Fig. 135.



*Right Innominata*,[3] is about an inch and a quarter in length, and is formed by the junction of the internal jugular[5] and subclavian[4] veins. At this junction it receives the right thoracic duct. It descends superficially and obliquely in front of the arteria innominata to join its fellow.

*Left Innominata.*[2]—This is much longer than the right, and is formed in the same manner. It receives at its commencement the left thoracic duct. It passes horizontally across the chest in front of the large vessels arising from the arch of the aorta, and behind the first bone of the sternum. It is frequently called the *transverse vein.* With its fellow, it forms the *descending* vena cava.

The descending vena cava is about three inches in length, and descends perpendicularly to enter the upper part of the right auricle.

## INFERIOR OR ASCENDING VENA CAVA.

This is formed by the junction of the iliac veins between the fou
fifth lumbar vertebræ. It ascen
the vertebral column to the right
aorta, and in its course recei
lumbar, right spermatic, renal,

patic veins; it passes through the fissure of the liver between the right lobe and the lobulus Spigelii, and then enters the foramen quadratum of the diaphragm, to terminate at the right auricle of the heart.

*Spermatic veins.*—These originate in the vasa pampiniformia of the cord and testicle. The *right*[13] empties into the ascending cava, and the *left*[14] into the left renal.

*Renal or Emulgent.*—These are large, and return the blood from the kidney to the ascending cava. The right[15] is much shorter than the left. The left passes in front of the aorta.

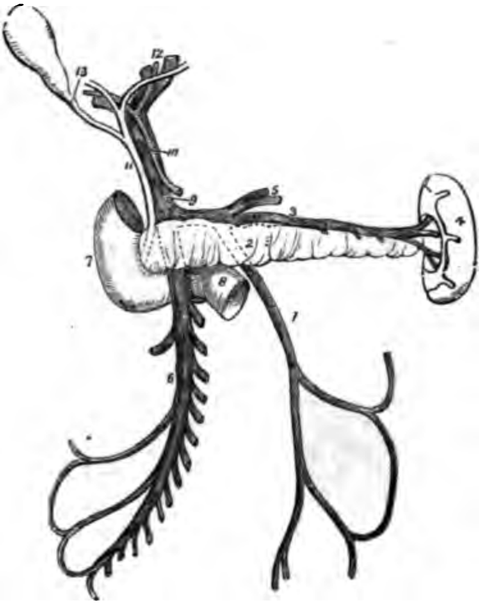
*Hepatic.*[16]—These convey the venous blood from the liver by three large branches, which open at its posterior notch, into the ascending cava, as it passes through the fissure in the liver.

## VENA AZYGOS.

This vein [17] commences in the lumbar regions, and being joined by the intercostal veins of the right side, it winds around the root of the right lung, and empties into the descending cava. It also receives the right bronchial and the right superior intercostal veins.

*Vena hemiazygos.*[18]—This is formed by the lower intercostal and superior lumbar veins, and passes in front[20] of the vertebral column to join the vena azygos.

Fig. 136.



*Left superior intercostal.*[21]—This receives the blood from the six superior intercostals, and the left bronchial vein; it forms a communication between the left subclavian and azygos veins.

The above veins form a communication between the venous blood of the upper and lower extremities, independent of its mingling in the heart. (Fig. 135.)

## PORTAL VEIN.

This vein[9] collects the blood from all the chylopoietic viscera, and enterɩ transverse fissure of the liver, divides into the right and left ı. In its course it receives the inferior[1] and superior[6] mesen-'eins, splenic,[8] and gastric;[5] and then is included with the ɜ artery,[10] and the ductus communis choledochus[11] in the cap-' Glisson. The veins forming the portal vein have no valves.

*cal plexus.*—This plexus surrounds the neck of the bladder, ıl vesicles, prostate gland; its blood passes into the internal ɜin.

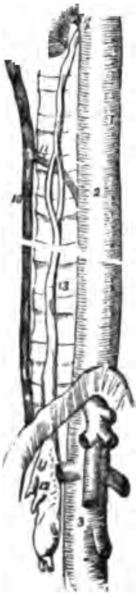
*ine plexus.*—Surrounds the uterus and vagina, and empties vesical does.

*morrhoidal veins.*—Surround the rectum, and empty into the r mesenteric and internal iliac veins.

### VEINS OF THE LOWER EXTREMITY.

superficial veins of the lower extremity are two in number.

Fig. 137.



*Internal saphena.*—Commencing upon the inside of the foot and ankle it ascends upon the inside of the leg, and passing behind the internal condyle, it traverses the superficial fascia of the thigh and enters the femoral vein at the saphenous opening of the fascia lata.

*External saphena.*—Commencing upon the outer and posterior parts of the foot, it ascends upon the back of the leg and enters the popliteal vein above the knee.

*Popliteal,* is formed by the junction of the deep veins accompanying the anterior and posterior tibial arteries. It is superficial to the popliteal artery.

*Femoral vein.*—The femoral vein commences at the opening in the adductor magnus tendon, and ascends the thigh in company with the femoral artery. It passes under Poupart's ligament, to become the external iliac vein. It lies upon the inside of the femoral artery, as it passes over the pubes, and forms the outer boundary of the crural ring.

### LYMPHATICS.

Lymphatics are small, pellucid vessels found in almost all portion of the body. They are exceedingly nu and found most constantly in co with veins.

They enter the lymphatic

which are most numerous in the neck, groin, axilla, loins, and mesentery, and then emerge from them.

The lymphatics of the intestine, commence in the villi of the intestine; they are often called *lacteals*, and contain the chyle.

They have three coats, like arteries, and present a knotted appearance when distended, owing to the existence of sinuses and valves.

*Left thoracic duct.*[13]—This is the principal lymphatic vessel of the body; it receives the contents of the lymphatics or absorbents of the lower extremity, by an enlargement called *receptaculum chyli*[19] (Pecquet); and entering the thorax through the hiatus aorticus, it traverses the thorax through the posterior mediastinum in front of the vertebral column, and between the vena azygos[20] and aorta.[8] After reaching the fourth dorsal vertebra it ascends obliquely to the left side, and enters[24] the junction[9] of the left subclavian and the internal jugular veins.

*Right thoracic duct.*[13]—It is a short trunk, formed by the union of the lymphatics of the right side of the head and neck, and right upper extremity. It terminates at the junction of the right subclavian in the right internal jugular vein.

## SECTION VI.

## NERVOUS SYSTEM.

The principal *divisions* of the nervous system are the Brain, Spinal Marrow, and Nerves.

The *tissue* of this system is included in membranes or sheaths, and consists of two differently coloured pulpy materials; one of which is the *white* or *medullary*, and the other the *gray*, *cortical*, or *cineritious*.

The *white* or *medullary structure* is *fibrous*; in the centre of each fibre or tubule is a stripe called the *cylinder axis of Purkinje*.

The *gray* is more vascular, and is *vesicular* in its structure. These vesicles contain a nucleus with a nucleolus. They are soft, and of a yellow or brownish colour.

All ganglia and nervous centres consist of a mixture of white fibres and gray globules. (See "Physiology.")

The sheath of the nerves is called the *neurilemma*, and the internal material *neurine*.

An *anastomosis* is the interchange of fasciculi between two trunks; each fasciculus remaining unaltered by, although in contact with, another.

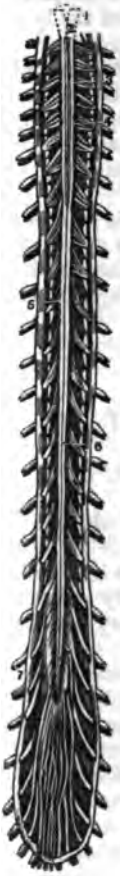
*exus* is a combination of anastomoses into a network.

*nian corpuscles* are small elliptical bodies, found attached to ar and digital nerves. They are of a dull white colour, or ent, and about two-thirds of a line in length.

## MEMBRANES OF THE SPINAL MARROW.

ig. 188.

Fig. 139.



The spinal marrow has three coverings. The *dura mater* is a white fibrous membrane, and is external. It is continuous with that of the brain, and, investing the spinal marrow loosely, terminates at its inferior extremity in a pointed cul-de-sac. It does not adhere closely to the bony canal, except at the intervertebral foramina, where it affords sheaths for the nerves. Between it and the walls of the bony canal is a quantity of loose cellular tissue infiltrated with fat and serum.

The *arachnoid* is the middle covering. This is a serous membrane, investing the spinal marrow, and lining the inner surface of the dura mater, to which it gives a smooth, polished appearance. It is extremely thin and transparent, and destitute of red blood-vessels.

The *pia mater* is the immediate covering. This is a cellular membrane, consisting almost entirely of vessels. It terminates in a round cord-like process, which reaches from the end of the spinal marrow to the bottom of the ca

aled in the roots of the nerves which constitute th

## SPINAL MARROW.

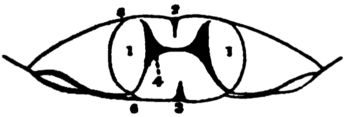
The spinal marrow is the medullary column included in the spinal canal of the vertebræ. It is cylindrical, and reaching from the atlas, terminates in a point at the first or second lumbar vertebra. It is flattened anteriorly and posteriorly, and has an enlargement in the neck and loins. It is divided longitudinally into symmetrical portions, by an anterior and a posterior fissure. The anterior[3] fissure is broad and shallow; the posterior[2] is deep and narrow. Each half is divided unequally by a lateral fissure; the anterior column being the larger.[1]

A transverse section of the spinal marrow exhibits the arrangement of its medullary and gray matter. The medullary matter is external, and the gray, in this section, resembles two crescents united by a commissure.

The posterior horns[4] of the crescent extend to the surface in the lateral fissure, in which originates the posterior[5] roots of the nerves.

From the sides of the spinal marrow proceed 30 pairs of nerves, each originating by two roots; the anterior from the anterior column, and the posterior from the lateral fissure, where they connect with the posterior horns. The posterior root is the larger, and upon it is a ganglion, which is in the invertebral foramen, beyond which the two roots unite. These two roots are separated by the *ligamentum denticulatum*, a pointed process of pia mater, which contains between its laminæ a good deal of yellow fibrous tissue.

Fig. 140.



## MEMBRANES OF THE BRAIN.

The brain has three membranes, of which the most external is the *dura mater*. It is of the same structure as the dura mater of the spinal cord, composed almost entirely of white fibrous tissue. It consists of two laminæ, which are only separate at the points where the *sinuses* exist.

It adheres firmly to the bones of the cranium, particularly to those at the base of the skull. The internal lamina forms several processes. The *falx cerebri* is a fold of the internal lamina, reaching in the median line from the crista galli to the tentorium, and separating the two hemispheres of the brain. The *tentorium* is another fold, stretched horizontally, and also of a crescentic shape, separating the cerebrum from the cerebellum. The *falx cerebelli* is a smaller fold, reaching from the internal occipital cross to the foramen magnum, and separating the lobes of the cerebellum.

The *arachnoid* is the serous membrane covering the brain, and e inner surface of the dura mater. It is thin and trans-

*pia mater* is a vascular covering consisting of arteries and
ited by a small quantity of cellular tissue. It passes down
ssures, between the convolutions, so as to invest them com-

The *Glands of Pacchioni* are usually small and white gra-
s, but sometimes are very large, especially in old persons.
e usually found along the margin of the longitudinal fissure,
etimes produce absorption of the dura mater.

## THE BRAIN.

rain consists of four principal parts: Medulla Oblongata,
arolii, Cerebrum, and Cerebellum.

### MEDULLA OBLONGATA.

is the upper part of the spinal cord; it is conical in its shape,
ends from the atlas to the pons Varolii. It is divided by the
and posterior fissures symmetrically, and each half consists
different parts.

*us pyramidale.*—This is a narrow, cylindrical portion, re-
g a cord, and situated in front. It communicates freely with
w, by a decussation of their fibres, about one inch from the

*us olivare.*—This is an oval, convex mass, behind and above
us pyramidale, from which it is separated by a fissure. It
half an inch in length. A section of it exhibits an arrange-
cineritious matter called *corpus fimbriatum.*

*us restiforme* is the posterior division of each lateral column,
eparated from the corpus olivare by a groove. Between it
fellow is a continuation of the posterior fissure called *cala-
iptorius,* across which pass transverse fibres of medullary
giving origin to the auditory nerve.

### PONS VAROLII.

is formed of medullary matter, and is cuboidal in shape.
lly, the fibres are transverse; internally, they are longitu-
eing a continuation of those of the medulla oblongata. It
ed in front of the medulla oblongata, and rests upon the
process of the occiput. From it proceed *four crura.*

### CEREBRUM.

erebrum is an oval mass, weighing from three to four pounds,
ided into two hemispheres by the superior lon

Each hemisphere consists of an anterior, middle,
be. The anterior and middle lobes are separated
f Sylvius. The division between the middle and

is an imaginary line in front of the anterior edge of the cerebellum. The surface presents a number of *gyri*, or convolutions, each separated by deep *sulci*, or fissures. The interior of each hemisphere is medullary, and the surface of each convolution is cineritious for the depth of one or two lines.

*Island of Reil* is a cluster of radiated convolutions in the fissure of Sylvius.

*Crura Cerebri*, are two thick, cylindrical white cords, which diverge from the anterior border of the pons, and their fibres terminate in the hemispheres of the brain. In a triangular space between them, is a layer of medullary matter called the *locus perforatus*.

*Eminentiæ Mammillares*, are two white, globular bodies, about the size of a pea, situated between the crura of the brain, and in front of the locus perforatus.

*Tuber Cinereum*, is a soft, gray mass, in front of the eminentiæ mammillares, and behind the chiasm of the optic nerves.

*Infundibulum*, is a hollow, conical body, of a reddish colour, with its base upon the *tuber cinereum*, and its apex attached to the *pituitary gland*.

*Pituitary gland*, is a vascular mass of a light colour, situated in the sella turcica. It consists of two lobes.

*Corpus Callosum*, is a white, arched band, seen at the bottom of the longitudinal fissure, forming a commissure between the two hemispheres. It is three inches and a half long, and about an inch broad. Its fibres are for the most part transverse, and consist of medullary matter, with the exception of a few, which pass longitudinally, and are called the *raphé*.

*Septum Lucidum*, is a vertical partition, consisting of two laminæ, and separating the lateral ventricles. Its upper edge is in contact with the *corpus callosum*, and its lower with the *fornix*.

*Fornix.*—It is a triangular, medullary arch, whose base is continuous with the *corpus callosum* posteriorly, and whose apex divides into two crura, which terminate in the *eminentia mammillares*; its under surface is termed *lyra*. Under these crura is the *foramen of Monro*, by which the third and two lateral ventricles communicate.

*Velum Interpositum*, is a triangular reflection of pia mater, immediately under the fornix; its edges contain a plexus of veins called *plexus choroides*.

*Pineal Gland*, is a small, reddish-gray, conical body, situated upon the *tubercula quadrigemina*, and connected by two crura with the optic tubercles.

*Tubercula Quadrigemina* are four prominences situated over the junction of the pons and crura cerebri. Under them is a passage called aqueduct of Sylvius, or *iter e tertio ad ventriculum quartum*.

*Corpus Striatum*, a gray mass of an oblong shape, situated in the lateral ventricle on either side. It is medullary within.

*amus Opticus*, is an oval, convex mass, behind the corpus
ι on each side. It consists of a mixture of medullary and
ıtter, and has three prominences called *corpora geniculata*,
either side, and one in front. It is connected with its fellow
ɜ cineritious substance, called the soft commissure.

*ia Striata*, is a thin edge of medullary matter, in the groove
ι the corpus striatum and thalamus opticus.

*ocampus major*, is a scroll extending into the inferior cornu
ateral ventricle, the extremity of which resembles a foot, and
d the *pes hippocampi*.

*us Fimbriatum*, or *Tænia Hippocampi*, is a thin edge of
ıry matter upon the concave side of the hippocampus major;
ι which is a layer of cineritious matter, having a serrate
nce, and called the *fascia dentata*.

*ocampus Minor*, or *Ergot*, resembles a cock's spur; is a
elevation pointing backwards into the *posterior cornu*.

*ricles of the Brain.*—These are five in number. They are
he *right* and *left lateral*, the *third*, *fourth*, and *fifth ventricles*.
*ral ventricles* exist in each hemisphere, and contain the *corpus*
*ı* and *thalamus opticus*. Each communicates with the third
fellow by the foramen of Monro, being separated partially
*septum lucidum*; the roof is formed by the corpus callosum.
ains three angular depressions called *cornua*; the anterior
s nothing; the posterior, the hippocampus minor; and the
, the hippocampus major.

*third ventricle* is the space between the *thalami optici*. Its
formed by the velum interpositum and fornix, and its floor
locus perforatus and the tuber cinereum. It is traversed in
y the anterior commissure, a medullary cord extending
ı the *corpora striata*, and by the posterior commissure,
extends transversely between the *thalami optici*. It com-
tes with the lateral ventricles by the foramen of Monro, and
e fourth by the aqueduct of Sylvius.

*fourth ventricle* is situated between the pons Varolii, cerebel-
ıd medulla oblongata. Its floor is the calamus scriptorius,
roof is the *valve of the brain*. Laterally, it is limited by
mater and the arachnoid. It communicates with the third.

*fifth ventricle* is situated between the laminæ of the septum
ı. It does not communicate with the other ventricles.

## CEREBELLUM.

constitutes about one-sixth of the brain, and is contained
ı the occiput and tentorium. It is oblong and fla
t diameter being transverse. It is composed of
ıbstances, the latter of which is external, and
d in laminæ. It is divided by a longitudinal f
es; the superior part of which fissure contains a r

*vermis superior*, in advance of which is an elevation called *monticulus*. In the inferior part of this fissure is a smaller ridge called the *vermis inferior*.

At the root of the crura cerebelli are two small protuberances; the one below it, in the erect position, is the *lobulus nervi pneumogastrici*, and the other the *lobulus amygdaloides*.

*The valve of the brain* is a thin *white lamina*, extending from the inferior surface of the cerebellum to the *corpora restiformia*.

*Arbor vitæ*, a section of either lobe of the cerebellum, presents an arborescent arrangement of the medullary matter.

*Corpus Dentatum*, or *Rhomboideum*, is a name applied to a gray mass with serrated edges, in the trunk of this medullary tree.

## CRANIAL NERVES.

These are nine in number, and are so called from their emerging through the foramina, at the base of the cranium. They are designated by their function, as well as numerically. Their origin is as follows:

1st. *Olfactory.*—Arises by three roots, which coalesce in the fissure of Sylvius.

2d. *Optic.*—Arises from the thalamus opticus and the tubercula quadrigemina.

3d. *Motor Oculi.*—Arises from the crus cerebri.

4th. *Patheticus.*—Arises from the valve of the brain.

5th. *Trifacial.*—Arises from the superior and posterior part of the pons Varolii.

6th.—*Motor Externus.*—Arises from the corpus pyramidale.

7th. *Facial and Auditory.*—The facial or *portio dura* arises in a groove between the corpus olivare and corpus restiforme near the pons Varolii. The auditory or *portio mollis* arises from transverse striæ upon the calamus scriptorius. The *portio intermedia* of the 7th arises in the corpus restiforme, and may be considered as the posterior or sensitive root to the facial.

8th. *Pneumogastric, glosso-pharyngeal, and spinal accessory.*—The first two arise by filaments from the fissure between the corpus olivare and the corpus restiforme; and the last arises from the spinal cord by a series of slender roots, as low down as the fourth or fifth cervical vertebra.

9th. *Hypoglossal.*—Arises in the fissure between the corpus pyramidale and corpus olivare.

The cranial nerves may be divided into three classes, according to their function, viz.:—*Nerves of special sense*, including the 1st, 2d, and the auditory branch of the 7th. *Nerves of motion*, including the 3d, 4th, 6th, facial branch of the 7th and 9th. *Compound nerves*, comprising the 8th and 5th.

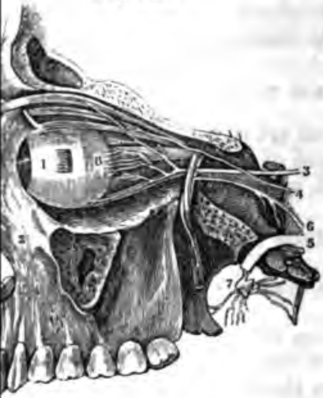
distribution of the cranial nerves—

*Olfactory.*—It has a large, soft bulb, which rests on the cri- n plate of the ethmoid bone, and sends filaments through its na to the Schneiderian membrane.

*Optic.*—Forms a chiasm with its fellow, and enters the globe eye through the foramen opticum, to join the retina. It is a ed cord.

*Motor Oculi.*[3]—Passes through the external wall of the cavernous sinus to escape at the sphenoidal foramen, and then is distributed upon the muscles of the eyeball, with the exception of the superior oblique and external rectus. It sends a *branch* to join the ophthalmic ganglion, from which proceed the ciliary nerves,[8] which supply the iris.

Fig. 141.



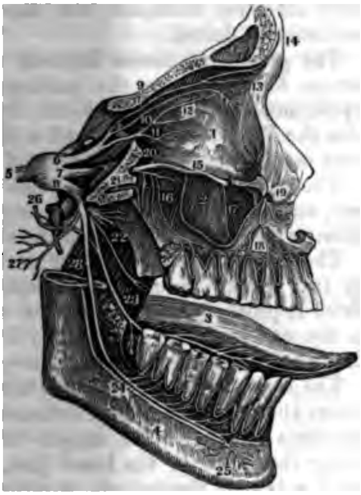
4th. *Pathetic.* — Passing through the external wall of the cavernous sinus, and through the sphenoidal foramen, it is distributed upon the superior oblique muscle of the eyeball. It is the smallest cranial nerve.

*Trifacial.*—The trifacial or trigeminus is the largest of the l nerves, and has a fibrous appearance. It resembles the spi- erves in arising by two roots, which can be traced into the or and posterior columns of the spinal marrow, and also in g a ganglion upon its posterior and larger root.

s ganglion is called Casserian, and rests upon the depression the anterior portion of the petrous portion of the temporal From it proceed three large branches, called ophthalmic, or maxillary, and inferior maxillary nerves. The first and l branches confer sensibility on the structures on which they ; but the third receives the motor filaments of the anterior and, therefore, confers motion as well as sensibility to the ures upon which it is distributed.

*ophthalmic*[6] passes out through the sphenoidal foramen into bit by three branches, the nasal, frontal, and lachrymal. The gives off the *internal nasal,* which enters the cranium anterior ethmoidal foramen, and then goes through the orm plate into the nose; and also a branch (*ramus cilia-* o the lenticular or ophthalmic ganglion. It is distributed

Fig. 142.



to the muscles of the orbit, eyelids, and conjunctiva. The *frontal*[9] divides into two branches, and is spent upon the integuments and muscles of the forehead; one branch goes through the supra-orbitary foramen. The *lachrymal*[10] branch supplies the lachrymal gland, and the contiguous portions of the orbit.

The *superior maxillary*[7] passes through the foramen rotundum, and then enters the pterygo-maxillary fossa.[20] A large branch called *infra orbital*[15] traverses the infra-orbital canal, and emerges at the infra-orbital foramen[19] to supply the face; giving off the *dental nerves*[16 17] in its course. The *pterygo-palatine branch*, or branches, join the *ganglion of Meckel* in the pterygo-maxillary fossa, from which proceed the spheno-palatine branches, which enter the nose through the spheno-palatine foramen; one of these branches is long, and called naso-palatine, which joins its fellow at the ganglion of Cloquet in the *foramen incisivum;* the posterior palatine, descends from the ganglion through the posterior palatine foramen, and is distributed to the palate and fauces; the *vidian*, or *pterygoid*, or *recurrent*,[21] passes backwards from the ganglion through the pterygoid foramen, and divides into two branches, called *superficial* and *deep petrous*. The superficial petrous enters the *hiatus Fallopii*, and passing between the smaller bones of the ear, emerges at the Glaserian fissure under the name of *chorda tympani*, which joins the submaxillary ganglion. The deep petrous enters the carotid canal, and joins the ganglion of *Laumonier*, which was formerly considered the origin of the sympathetic nerve.

The *inferior maxillary*,[8] is the largest branch of the 5th pair. It is composed of filaments from the Casserian ganglion, and of the anterior or motor root of the tri-geminus. It emerges from the cranium through the foramen ovale, and soon divides into two principal trunks which are separated from each other by the external pterygoid muscle. The *external* trunk is composed mostly of the motor filaments, and splits into five branches, which are distributed to the masseter, buccal, pterygoid, and temporal muscles. One of the temporal branches perforates the temporal fascia and communicates with the auricular and facial nerves. The internal trunk gives off three branches, viz., the gustatory, superficial temporal, and inferior dental.

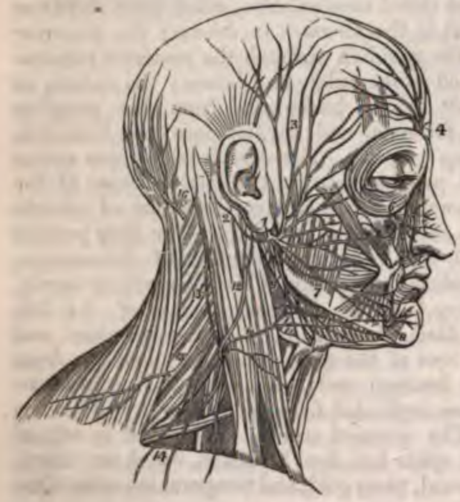
The *gustatory*, passes between the pterygoid muscles, and then curves forward above the sublingual gland and beneath the mylohyoid muscle and parallel to the stylo-glossus muscle.—It accompanies the Whartonian duct, and is distributed to the papilla and mucous membrane upon the sides and tip of the tongue.

The chorda tympani nerve joins it near the condyle of the lower jaw, and parts from it near the angle, to join the submaxillary ganglion, whose branches pass in the submaxillary gland.

The *superficial temporal*, or auriculo-temporal, often commences by two roots, between which passes the meningea magna artery. From it proceed several branches, to the parotid gland, to the joint, to the external ear, and to the side of the head, in company with the branches of the temporal artery.

The *inferior dental* descends between the pterygoid muscles, and enters the posterior mental foramen after having given off the *mylo-hyoidean* branch to the muscle of the same name. It then runs along the canal in the lower jaw, supplying the teeth, and then sends a branch through the anterior mental foramen, which is distributed upon the chin.

Fig. 143.



The *otic ganglion*, a small, reddish-gray body, is situated upon the inferior maxillary nerve, near its emergence from the foramen ovale.

6th. *Motor Externus.*—Passing through the cavernous sinus, it escapes from the cranium through the sphenoidal foramen or fissure, and is distributed to the external rectus muscle of the eyeball. Its paralysis will produce an internal squint. A branch enters the carotid canal to join the ganglion of Laumonier.

*acial and auditory.*—Both branches enter into the internal the auditory is also called *portio mollis*, and is distributed ternal ear. The facial, also called *portio dura*, passes he aqueduct of Fallopius, where it is formed by the super-rous, and emerges from the temporal bone at the stylo-oramen.[1] (Fig. 143.)

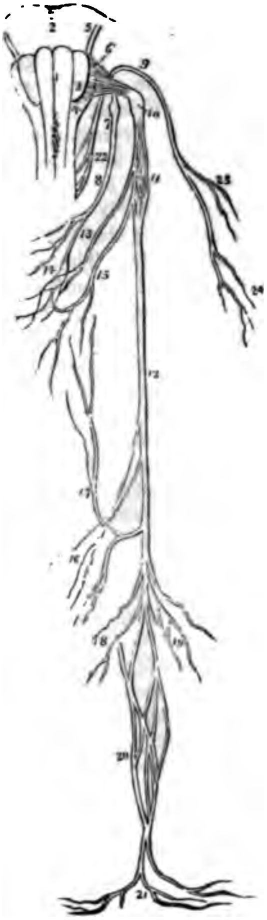
it enters the parotid gland, it gives off the posterior auricu-stric, and stylo-hyoid branches.

ses through the gland a plexus, called the pes anserinus, from oceed two principal branches, temporo-facial and cervico-he temporo-facial is distributed ral, buccal, and malar branches, s of the face; the cervico-facial uted by branches to the muscles lower jaw and neck, which cate with the cervical nerves.

h consists of three branches, the aryngeal, the pneumo-gastric, spinal accessory, all of which om the cranium at the posterior lacerum or jugular foramen. 4.)

*osso-pharyngeal* is the highest f this pair. It passes out of the by a distinct fibrous canal in the and descends between the in-gular vein and the carotid artery d line, adhering to the stylo-us muscle. It is inferior to, er in the neck than the gustatory Upon it are two ganglions—one jugular foramen, and involves rt of the nerve; and the other trous or Anderschian ganglion.[7] rises numerous branches, which icate with the facial, the sym- and the pneumo-gastric, and filament called Jacobson's nerve. ve enters the tympanum through pening between the jugular and ramina, to form the *plexus* upon wall of the tympanum, in which pair and the sympathetic com-e.

Fig. 144.



emporal branches perforates the temporal fascia and commu- with the auricular and facial nerves. The internal trunk ff three branches, viz., the gustatory, superficial temporal, erior dental.

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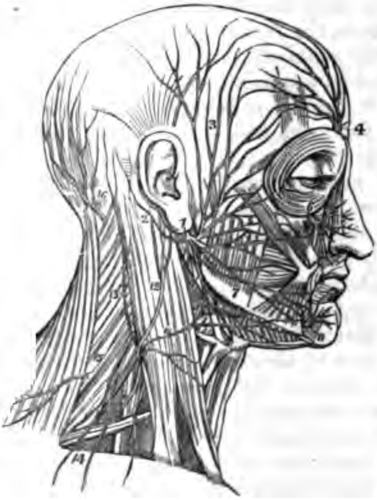
Fig. 143.



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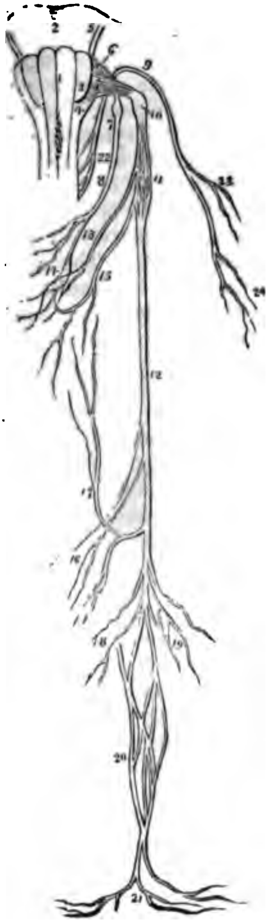
6th. *Motor Externus.*—Passing through the cavernous sinus, it escapes from the cranium through the sphenoidal foramen or fissure, and is distributed to the external rectus muscle of the eyeball. Its paralysis will produce an internal squint. A branch enters rotid canal the ganglion - **monier.**

7th. *Facial and auditory.*—Both branches enter into the internal meatus; the auditory is also called *portio mollis*, and is distributed to the internal ear. The facial, also called *portio dura*, passes through the aqueduct of Fallopius, where it is formed by the superficial petrous, and emerges from the temporal bone at the stylomastoid foramen.[1] (Fig. 143.)

Before it enters the parotid gland, it gives off the posterior auricular, digastric, and stylo-hyoid branches. As it passes through the gland a plexus is formed, called the pes anserinus, from which proceed two principal branches, viz., the temporo-facial and cervico-facial. The temporo-facial is distributed by temporal, buccal, and malar branches, to muscles of the face; the cervico-facial is distributed by branches to the muscles upon the lower jaw and neck, which communicate with the cervical nerves.

Fig. 144.



The 8th consists of three branches, the glosso-pharyngeal, the pneumo-gastric, and the spinal accessory, all of which emerge from the cranium at the posterior foramen lacerum or jugular foramen. (Fig. 144.)

The *glosso-pharyngeal* is the highest branch of this pair. It passes out of the cranium by a distinct fibrous canal in the foramen, and descends between the internal jugular vein and the carotid artery in curved line, adhering to the stylo-pharyngeus muscle. It is inferior to, and deeper in the neck than the gustatory nerve. Upon it are two ganglions—one is in the jugular foramen, and involves only a part of the nerve; and the other is the petrous or Anderschian ganglion.[7] From it arises numerous branches, which communicate with the facial, the sympathetic, and the pneumo-gastric, and also the filament called Jacobson's nerve. This nerve enters the tympanum through a small opening between the jugular and carotid foramina, to form the *plexus* upon the inner wall of the tympanum, in which the 5th pair and the sympathetic communicate.

the glosso-pharyngeal are given off branches, which with from the sympathetic and pneumogastric form the *pharyn-* exus.[14] It supplies the papillæ at the posterior part of the and the mucous membrane of the pharynx, and also some of scles of the tongue and pharynx.

*pneumogastric* having escaped from the cranium by the pos- oramen lacerum, or jugular foramen, presents a ganglionic ment[11] called plexus gangliformis. A small ganglion[10] is also pon that portion which passes through the foramen. It then ls within the sheath of the vessels of the neck, lying behind ween the artery and vein, and entering the thorax and abdo- upplies the lungs and stomach, giving off the following es: the *superior pharyngeal,*[13] which assists in forming the geal plexus,[14] assisted by branches from the glosso-pharyngeal, erior laryngeal, and sympathetic. This plexus is distributed muscles and mucous membrane of the pharynx.

*superior laryngeal*[15] arises from the ganglionic plexus, enters nx, and is distributed to its mucous membrane. The *cardiac* es[16] are two or three in number, and descend to join the plexus. The *inferior laryngeal,*[17] or *recurrent laryngeal,* around the aorta upon the left side, and the subclavian upon ht; ascending between the trachea and the œsophagus, it is ted to the muscles of the larynx, communicating with the r laryngeal and the sympathetic nerve. *Anterior* and *pos-* [19] *pulmonary* branches are given off in the thorax to form lmonary plexus. The *œsophageal branches*[20] surround the gus, and with it enter the abdomen through the diaphragm, be spent upon the stomach and neighbouring viscera, and nmunicate with the solar plexus.

*al accessory.*—This branch[9] of the eighth pair escapes also at gular foramen, and divides into two branches, one of which laments to the superior pharyngeal nerve; the other, which arger, descends obliquely backwards, and piercing the sterno- l muscle, is distributed to the trapezius, after having commu- with the upper cervical nerves.[23, 24]

The *Hypoglossal nerve* emerges from the cranium through erior condyloid foramen; it then passes between the internal artery and internal jugular vein, and curving around the l artery, sends branches to the muscles of the tongue. A *descendens noni,* descends as a long, thin filament, in front sheath of the vessels, and below the middle of the neck; g a loop with a branch from the second and third cervical It communicates with the pneumogastric and symp

## SPINAL NERVES.

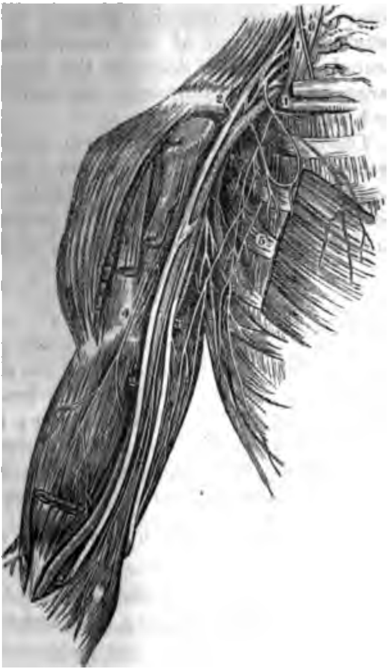
e are thirty pairs of spinal nerves, each arising by tw r the union of the anterior or motor root with the p or sensitive root in the intervertebral foramen, the spinal nerves divide into two trunks, the *posterior* of which are much the smaller, and supply the muscles of the back; the *anterior* are large, and communicating with the ganglions of the sympathetic nerve, form plexuses which give off the principal nerves to the muscles of the trunk and extremities.

### CERVICAL NERVES.

These are eight in number: the first is called the *sub-occipital;* it passes out of the spinal canal between the occiput and atlas, in a groove beneath the vertebral artery. It supplies the recti muscles, and unites with the first cervical so as to form a loop around the transverse process of the atlas. (Fig. 148.)

*Three superior cervical* nerves anastomose freely and form a *cervical plexus*, which sends numerous branches to the muscles and skin of the neck, forming communications with the ninth and facial nerves. The principal branches from this plexus are the superficial,[10] [12] [16] the great auricular,[13] the occipital,[13] and the supra-clavicular. The *phrenic* nerve[16] (Fig. 145), is formed by filaments from the second and third cervical nerves, and passing over the scalenus anticus muscle, and through the anterior mediastinum, adheres to the pericardium. It is distributed to the diaphragm by several branches. The right passes in front of the innominata, the left passes in front of the aorta, and is more deeply situated than the right in the thorax.

Fig. 145.



The *four inferior cervical* nerves, together with the first dorsal, emerging from the spinal canal between the scalenus anticus and medius muscles, form a large plexus, by their anterior branches, which is plaited around the subclavian and axillary arteries.

The *brachial plexus* gives off the following branches: the *supra-scapular* branch, which ascends upon the shoulder and supplies its muscles; passing through the coracoid notch.

*Posterior* or *long thoracic branch* is distributed to the serratus
s muscle. (External respiratory nerve of Bell.)
*sub-scapular* branches are two in number, and supply the
pular muscle.
*anterior* or *short thoracic* are two in number, and supply the
l muscles.
lesser internal cutaneous, or nerve of Wrisberg, is distributed
skin of the upper and posterior part of the arm. It is fre-
r joined by the first intercosto-humeral nerve.
*circumflex* or *axillary* nerve winds round the head of the
is, in company with the posterior circumflex artery, and is
ited to the deltoid muscle. The *internal cutaneous* is a very
thin filament passing down the inside of the arm, and sends
es across the superficial veins at the elbow, then is distri-
o the skin, fascia, and fore-arm. The *external* or *musculo-*
*us*[4] perforates the coraco-brachialis, and is also distributed
muscles in front of the arm and integument of the fore-arm.
*ulnar,*[3] descending the arm, passes superficially under the
l condyle, and is finally distributed to the little finger, and
ar side of the ring finger.
*radial* or *musculo-spiral* is the largest of these nerves which
rom the brachial plexus; it winds around the humerus,
n the head of the triceps muscle, which it supplies with
es, and then descends the fore-arm supplying its muscles; a
branch accompanies the radial artery, supplying the wrist
imb.
*median*[2] descends the arm in close company with the brachial
until it reaches the elbow; it there passes between the two
of the pronator teres muscle, and descending the fore-arm,
n the flexor sublimis and profundus muscles, it is distributed
ingers, with the exception of those supplied by the ulnar.

### DORSAL NERVES.

e are twelve in number; the anterior branches are the larger,
received into the intercostal grooves, in which they run, to
ibuted to the muscles of the chest.
*first dorsal nerve* joins the brachial plexus. The *intercosto-*
*l nerves*[5] are two in number; they proceed from the second
rd dorsal nerves, and perforate the second and third inter-
paces, to be distributed upon the skin of the arm; the first
tly joins the nerve of Wrisberg.

### LUMBAR NERVES.

e are five in number; the anterior branches of the
lescending form the *lumbar plexus*, which is situated
as magnus muscle; it is frequently connected with
ierve.

The *abdomino-crural*[3] branches are two or three in number, and pass obliquely over the quadratus lumborum muscle, and supply the muscles of the abdomen and the skin of the groin and genitals.

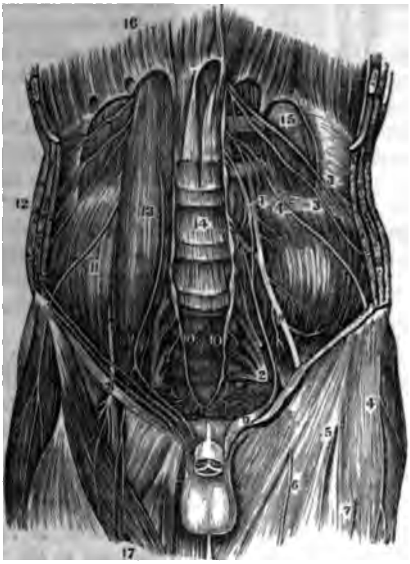
The *external cutaneous*[4] crosses obliquely the iliacus internus muscle, towards the anterior superior spinous process. It perforates the fascia lata, and is distributed to the integument of the thigh.

The *external spermatic*[8] or genito-crural perforates the psoas muscle, and descending to the groin, supplies the cremaster muscle and skin of the thigh.

The *anterior crural*[9] is the largest branch of the lumbar plexus. It emerges from under the psoas magnus muscle and passes under Poupart's ligament. It gives off the *anterior*, *middle*, and *internal cutaneous* branches,[5 6 7] which are distributed to the integuments; the *long*, or *internal*, or long *saphenous* nerve, accompanies the femoral artery as far as its perforation of the adductor tendon, and then accompanies the saphena vein to the foot.

The *obturator* accompanies the obturator artery, and emerges from the pelvis at the upper portion of the thyroid foramen. It is distributed upon the obturator and adductor muscles.

Fig. 146.



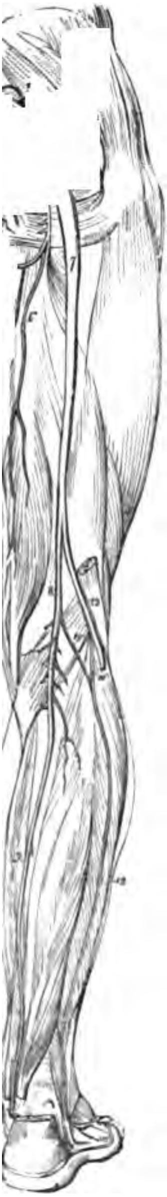
## SACRAL NERVES.

These are five and sometimes six in number; the anterior trunks of the four upper, with a portion of the last dorsal, constitute the *sacral plexus*. The fifth and sixth are distributed to the gluteus maximus muscle, and to the skin. The sacral plexus is triangular in its shape, and situated upon the pyriformis muscle. From it are derived a few small branches sent to the muscles and viscera of the pelvis, and also the following nerves to the lower extremity.

The *gluteal*,[1] which, emerging from the sacro-sciatic notch, divides into two large branches to supply the glutei muscles. (Fig. 147.)

The *pudic*,[2] or *superior long pudendal*, accompanies the internal pudic artery, and supplies the perineum, and organs of generation;

Fig. 147.



it divides into two branches, the *superior* continuing to the extremity of the penis with the dorsal artery.

The *lesser ischiatic*[3] escapes from the pelvis between the pyriformis muscle and the great sacro-sciatic ligament, and divides into the *inferior long pudendal* or *perineal*,[5] which winds around the tuberosity of the ischium, and is distributed to the integuments of the perineum; and the *posterior cutaneous*,[6] a long filament passing down the back of the thigh and leg, to be spent upon the integuments.

The *great sciatic*[7] is the largest nerve in the body; it escapes from the pelvis beneath the pyriformis muscle, and descends the back of the thigh between the flexor muscles; about one-third above the knee, it divides into two large branches, called *peroneal* and *popliteal*.

The *popiteal*[8] descends through the popliteal space, giving off numerous muscular and cutaneous branches, one of which is the *external* or short *saphenous nerve*,[10] is joined by the internal peroneo-cutaneous nerve,[11] and becomes superficial near the ankle; it then passes behind the external malleolus, and supplies the skin, external malleolus, and the foot.

The *posterior tibial*[9] is a continuation of the popliteal, descending the back of the leg in company with the posterior tibial artery; it is finally distributed upon the sole of the foot by two branches called the *external* and *internal plantar* nerves.

The *internal plantar* is the larger, and is distributed to the first, second, and third toes, and to the inner side of the fourth.

The *external plantar* is distributed to the little toe, and the outer side of the next toe.

The plantar nerves are distributed to the toes upon the same plan as the median and ulnar nerves are to the fingers.

The *peroneal nerve* extends tow
head of the fibula, passing between
ternal side of the tendon of the b
the outer part of the external he
gastrocnemius. It gives off the

cutaneous branches, and then divides into the external peroneal and anterior tibial. The *internal peroneo-cutaneous* is the largest cutaneous branch; it joins with the external saphenous or *communicans tibiæ*.

The external peroneo-cutaneous is distributed to the skin along the fibula.

The *external peroneal* passes down upon the fibular side of the leg, through the peroneus longus muscle; and becoming superficial in the lower third of the leg, perforates the crural fascia, and is distributed to the integuments of the foot and ankle.

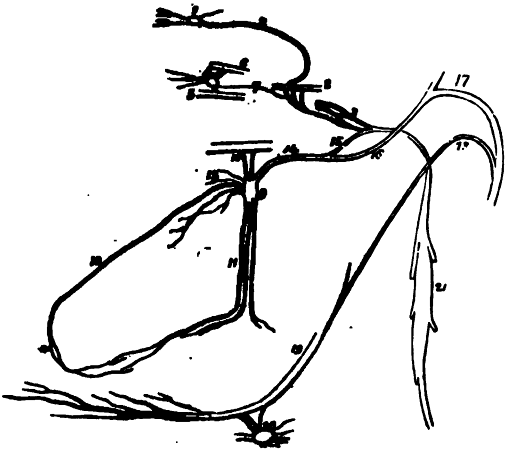
The *anterior tibial* descends in front of the interosseous ligament, in company with the anterior tibial artery, and is distributed to the muscles of the leg, and to the muscles and skin upon the foot.

## SYMPATHETIC NERVE.

The sympathetic system consists of two chains of ganglia, united to each other and to the cranial and spinal nerves. Each ganglion may be considered as a distinct nervous centre, and is placed opposite the intervertebral space. The two sides of the sympathetic system are united in the head by the ganglion of Ribes, which may be considered as the origin of the sympathetic nerve. There is also a ganglion in the median line of the coccyx, whereby the two lateral halves of the sympathetic are united below.

It is distributed in connexion with all the other nerves of the body, and by means of plexuses supplies all the internal organs; these plexuses take the name of the artery with which they are connected, or of the organ to which they are distributed.

Fig. 148.



*cranial* ganglia of the sympathetic are five in number, viz.:
*on of Ribes*,[1] which is small, and situated upon the anterior
unicating artery; a filament of it[2] joins the sixth nerve,[8]
communicates with the carotid plexus.[3] The *carotid plexus*
nds the carotid artery in the carotid canal, and frequently
s a ganglion called after *Laumonier*. This plexus is joined
*deep petrous* branch of the vidian nerve, and was formerly
red the origin of the sympathetic.

*lenticular* ganglion[4] is small and flattened, reposing between
tic nerve and the external rectus muscle. This ganglion
unicates with a branch of the nasal nerve,[6] and a branch of
rd, called ciliary[5]; a small filament[7] passes from this ganglion
the carotid plexus.

*spheno-palatine* ganglion is called also *Meckel's* ganglion.[9]
his are given off the vidian nerve,[14] the deep petrous branch
h joins the carotid plexus, as has been mentioned, and the
cial petrous,[16] which enters the hiatus Fallopii, and emerging
Glaserian fissure as the chorda tympani,[12] descends in con-
with the gustatory nerve[19] to join the *submaxillary ganglion*.
*ganglion of Meckel* communicates with the superior maxil-
rve by means of its two ascending branches, called *pterygo-*
*e*.[10] One of its spheno-palatine branches,[12] called naso-pala-
joins its fellow in the foramen incisivum, to form the ganglion
uet,* or naso-palatine ganglion. Its descending branches[11]
the palate, gums, and fauces.

*otic* ganglion (Arnold's), is a small oval ganglion, adhering to
er surface of the inferior maxillary nerve, below the foramen
it sends branches of communication to the superior and infe-
xillary, to the vidian and tympanic nerves, and it also sup-
e tensor tympani and the tensor palati muscles.

## CERVICAL GANGLIA.

e are three in number. The *first*[1] is a long, gray, spindle-
ganglion, extending to the lower border of the third cervical
a, behind the sheath of the vessels of the neck. Its branches
nerous, and some are very soft, hence termed *nervi molles*.
ommunicate with the anterior trunks[4] of the first, second,
ird cervical nerves; and by an ascending branch[2] with the
plexus, and by a descending branch[3] with the second cervical
n. Its internal branches[5] join the facial, eighth, and ninth
and the pharyngeal plexus. A number of branches join to
e *superior* cardiac nerve,[6] which descends behind the vessels
ns the cardiac plexus.

*middle cervical* ganglion is usually small, and so
g. It rests upon the inferior thyroid artery in fron
sixth cervical vertebra. It is often called the *thyr*
Its branches join the superior and inferior cervica

and the anterior trunks of the third, fourth, and fifth cervical nerves; it also sends the *middle cardiac nerve*[7] to join the cardiac plexus.

The *inferior cervical ganglion* is larger than the last, and is situated in front of the root of the transverse process of the seventh cervical vertebra. Its filaments join the sixth, seventh, and eighth cervical nerves, and also form the *inferior cardiac* nerve, which joins the middle cardiac nerve and the cardiac plexus.

The *cardiac plexus* is situated behind the arch of the aorta, upon the bifurcation of the trachea. Its branches, in conjunction with the par vagum and descendens noni, form the anterior and posterior cardiac plexuses; from these plexuses are derived the filaments which supply the heart.

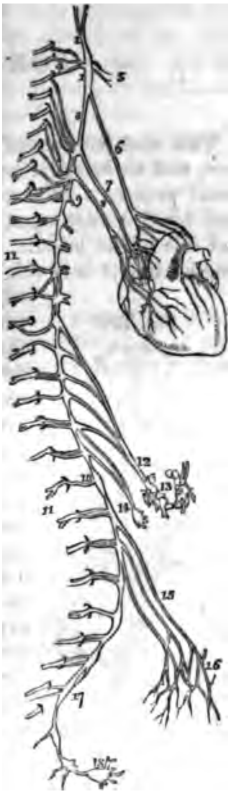
## THORACIC GANGLIA.

These are twelve in number, situated at the intervertebral spaces. They are small and connected with each other as well as with the anterior trunks of the spinal nerves. The great *splanchnic*[12] is formed by filaments from the sixth to the tenth ganglion; it descends in the posterior mediastinum, and pierces the diaphragm at or near the foramen aorticum, to form the semilunar ganglion. The *lesser splanchnic nerve*[14] is formed by filaments from the tenth and eleventh ganglia; it pierces the diaphragm and joins the semilunar ganglion and the renal plexus.

The *semilunar ganglion*[13] consists of a number of smaller ganglia formed upon filaments of the splanchnic nerve after it has entered the abdomen; they are arranged in a crescentic manner,[13] and situated upon the aorta and cœliac axis.

The *solar plexus* is a network on the sides of the aorta, and extends as far as the renal arteries. It is a number of filaments connecting the portions of the semilunar ganglia; and from it proceed smaller plexuses, which accompany the large arterial trunks; thus, the *hepatic plexus* is the network which surrounds the hepatic artery, and is distributed to the liver, gall-bladder, &c. The *splenic plexus* accompanies the splenic artery and supplies the spleen; thus also, are distributed, the renal, mesenteric, and other plexuses.

Fig. 149.



### LUMBAR AND SACRAL GANGLIA.

*lumbar ganglia* are four or five in number, which are united ch other and the spinal nerves. They form a plexus upon a, which receives filaments from the solar and hypogastric s.

*hypogastric plexus*[16] is formed by branches of the lumbar[15] tic plexuses and filaments from the *sacral ganglia*. From applied all the viscera of the pelvis. The sacral ganglia are r four in number. The last is called *impar*[18] or *azygos*, being l in the median line of the coccyx, and constituting the *terminal ganglion* of the sympathetic.

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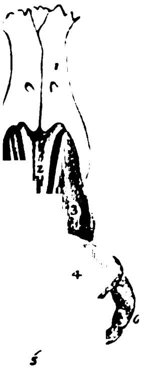
## SECTION VII.

## ORGANS OF SENSE.

### NOSE.

Fig. 150.



nose consists of two portions, an external projection upon the d an internal cavity. The *external* portion is formed by the processes of the superior maxillary bones, the nasal bones, five cartilages, two of which are placed upon either side in the middle. The *cartilaginous septum* is placed in the line;[2] it is thick, flat, and triangular, uniting by its superior edge with the ethmoid, and by its inferior edge with the vomer. Its anterior edge unites with the *lateral* and *alar* cartilages. It frequently deviates from the median line. The *lateral* cartilages[3] are triangular, one being placed on either side, attached above and behind to the bone, in front with the septum, and below with the alar cartilage. The *alar* cartilages[4] are two in number; they form the lower portion of the nose, and the opening called the nostril. It is an irregular, semi-elliptical cartilage, and has a number of small pieces of cartilage attached to it, by which the nostril is kept open. These cartilages are held together by a fibrous tissue. The skin which covers the nose is thick and strong, and covered with numerous seb follicles, which are frequently recogni eing discoloured. The hairs visible in the nostril are

The cavity of the nose is formed by the nasal fossæ. The roof is the cribriform plate of the ethmoid, the floor is the hard palate. Upon each side there are three scrolls formed by the turbinate bones. Between the superior and middle turbinate bones is the *superior meatus;* between the middle and inferior turbinate bones is the *middle meatus;* between the inferior turbinate bone and the floor of the nose is the *inferior meatus.* It is lined by a mucous membrane called *pituitary,* or *Schneiderian,* which is thick, soft, and red, owing to its vascularity, and largely supplied with nerves, being the seat of smell. It lines the meatuses of the nose, and is continuous with the mucous membrane of the mouth, lachrymal canal, Eustachian tube, frontal sinus, and ethmoidal cells. It is supplied by the first and fifth pairs of nerves.

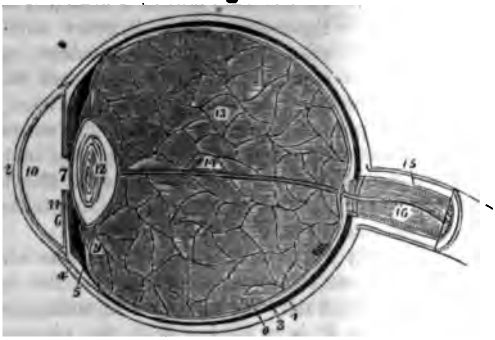
## THE EYE AND ITS APPENDAGES.

The *eyeball* is a sphere, of about one inch in diameter, antero-posteriorly, and somewhat less transversely. It is surrounded by a fibrous capsule, which is continuous with the sheath of the optic nerve behind, and the cartilages of the eyelids in front. All the muscles of the ball of the eye lie behind this capsule or fascia, and perforate it, in order to be inserted into the sclerotic coat.

The *sclerotic coat*[1] is a dense, fibrous, white membrane, thinner in front, where it receives the cornea, than it is behind, where it is perforated by the optic nerve. The circular edge in contact with the cornea is bevelled. The external surface is anteriorly covered by the *conjunctiva,* and posteriorly by fat. Its internal surface is connected with the choroid coat. It is perforated by numerous small foramina transmitting arteries and nerves.

The *cornea*[2] fills up the opening in the anterior part of the sclerotica, and forms about one-sixth of the whole eyeball; it is more convex than the sclerotica, and therefore forms a projection in front.

Fig. 151.



ınsparent and apparently homogeneous, but is in fact com-
ıf numerous laminæ, between which there is a slight quantity
. It is covered anteriorly by the conjunctiva, and posteriorly
epithelium of the aqueous humour.

*canal of Fontana* is a venous sinus, near the border of the

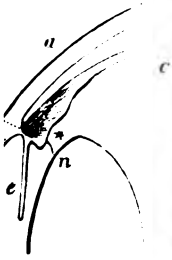
*choroid coat*[3] is a thin, vascular tunic of the same extent as
ɜrotica, with which it is in contact externally. It is filled
black colouring matter called *pigmentum nigrum*, and con-
ˑincipally of arteries and veins. It is traversed by several
Its internal layer is composed principally of arteries, and
*nembrana Ruyschiana;* externally it is composed principally
s, called *vasa vorticosa.*

*ciliary ligament*[4] is a flat, gray, delicate ring, at the junction
cornea and sclerotica, which unites the external border of
and the ciliary body.

*ciliary body*[5] is formed by the anterior portion of the cho-
at, in contact with the ciliary ligament, and from it proceed
ʳ or eighty short folds, called *ciliary processes*, which con-
.nd are smaller behind than they are in front; they surround
s.

*ciliary muscle* is a small, gray structure, behind the ciliary ligament,[d] and covering the outside of the ciliary processes. Its contraction presses the lens[n] towards the cornea.[b]

Fig. 152.



The *iris* (fig. 151) is a thin, circular membrane,[6] consisting of contractile tissue, and forming a vertical septum between the anterior and posterior chambers of the eye. It is perforated nearly in the centre by a foramen called the *pupil*,[7] which in fœtal life is closed by the *membrana pupillaris.* Its external border is attached to the ciliary ligament. The anterior surface is flat, of a bluish or brown colour, speckled and striated; towards the pupil the colour is
Its posterior surface (sometimes called the *uvea*) is covered
thick layer of pigmentum nigrum, and is in contact with the
ɔrocesses. It may contain a few muscular fibres in its structure.
ıpplied by the ciliary arteries, branches of the ophthalmic,
the ciliary nerves, which pass from the lenticular ganglion
ı the choroid coat to be distributed upon it.

*retina*,[8] is a soft, white membrane, within the choroid
:onsidered by some to be an expansion of the optic
others as a distinct nervous structure in connexion w
ɜrve. Internally it is in contact with the vitreous h

It commences at the optic nerve, and terminates anteriorly by a jagged edge, called *ora serrata*, behind the ciliary body. It is thicker behind than it is in front. When perfectly fresh it has a pinkish tint, and is semi-transparent. Its inner surface is of a fibrous character, consisting of radiating tubular fibres of the optic nerve. Its external surface consists of a finely-granulated matrix, interspersed with very delicate vessels. The *optic nerve*,[15] enters the globe of the eye on the inner side of its axis, and the point where it is connected with the retina is incapable of vision. Directly in the axis there exists upon the retina the yellow spot of *Soemmering*, a slight elevation with a minute perforation in its summit. The central artery of the retina enters through the optic nerve, and traversing the vitreous humour, supplies the retina and lens.

*Membrana Jacobi*.—Is a thin lamina, existing between the choroid and the retina, consisting of a number of club-shaped rods, interspersed with transparent cells.

The *vitreous humour*[13] has a transparent, jelly-like appearance, and is of a globular form. It consists of a viscous fluid, held in cells formed from the hyaloid membrane, which surrounds it. It is colourless, and its structure is best exhibited by freezing.

The *canal of Petit*,[8] is formed between the laminæ of the hyaloid membrane, and surrounds the edge of the lens.

The *zone of Zinn*, is a circle of plaitings upon the vitreous humour, which dove-tail with the ciliary processes.

The *Crystalline lens*[18] is a double convex lens, whose posterior surface is more convex than its anterior. In childhood it is spherical, and in old age it is flattened. It is transparent and soft, and surrounded by a capsule which contains a thin fluid, called *liquor Morgagni*. It consists of concentric laminæ, having a tendency to divide into three equal segments.

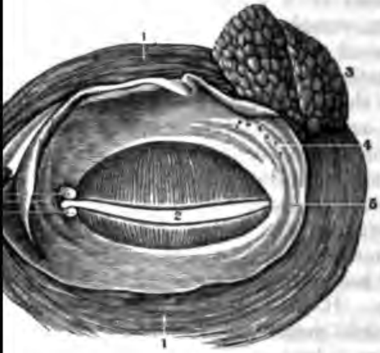
The *aqueous humour*[19] is a transparent fluid, occupying the anterior and posterior chambers of the eye, bathing the posterior surface of the cornea, and the anterior surface of the capsule of the lens. It is from four to five grains in quantity. This is said to be secreted by the membrane of Demours, which lines the whole of the anterior and posterior chambers. This membrane can only be traced upon the posterior surface of the cornea.

The *eyebrows* are two elevations of the skin covered with short, stiff hairs, protecting the eye from too strong a light, and from the perspiration flowing down the forehead; they materially affect the expression of countenance. The space between the two is called *glabella*.

The *eyelids* or *palpebræ*, consist of skin, muscular fibres, cartilage, and mucous membrane; and when in contact, leave a triangular canal, which passes transversely between them. Their edges are d with *cilia*, or eyelashes, which are short, stiff, curved hairs, ting the eyeball.

*sal cartilages.*—Are two in number. That of the upper lid is larger than that of the lower; they are crescentic in shape, and attached by the external and internal palpebral ligaments.

Fig. 153.



*Conjunctiva.*—Is a soft mucous membrane lining the lids, and covering the anterior surface of the ball, forming a fold called *plica semilunaris,* near the inner canthus. It is vascular, and well supplied with nerves.

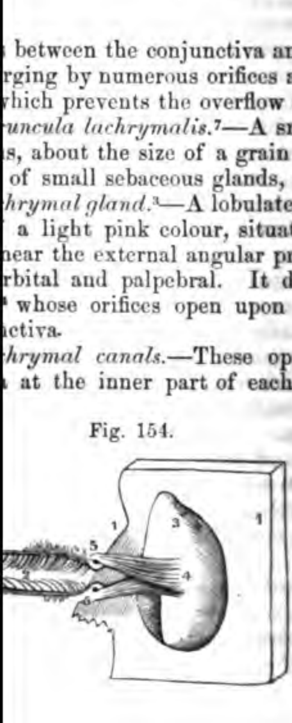
*Meibomian glands.*—Are twenty or thirty small yellow thread-like between the conjunctiva and the posterior surface of the lids, rging by numerous orifices along the edges of the lids a viscid hich prevents the overflow of tears at night.

*uncula lachrymalis.*[7]—A small, red elevation, in the internal s, about the size of a grain of wheat; consisting of an aggre- of small sebaceous glands, and often furnished with hairs.

*hrymal gland.*[3]—A lobulated gland, about the size of a filbert, a light pink colour, situated in a fossa on the roof of the ear the external angular process. It consists of two portions, rbital and palpebral. It discharges tears by ten or twelve whose orifices open upon the upper and outer part of the ctiva.

*hrymal canals.*—These open by two small orifices upon a at the inner part of each lid, called *puncta lachrymalia.*[6] The tears enter these orifices and are conveyed along a bent canal into the lachrymal sac.

Fig. 154.



*Tensor tarsi* or *Horner's muscle.*—(Fig. 154.)—Arises from the os unguis,[4] and is inserted by two divisions[5] into the orifices of the lachrymal canal. Its nasal face adheres to the lachrymal sac.

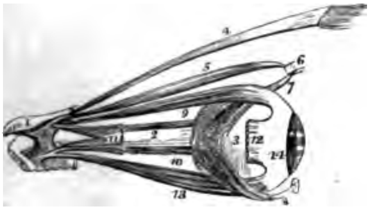
*Lachrymal sac* and *nasal duct.*—Is a continuous tube contained in the passage formed by the nasal process of the superior maxillary, the unguiform, and inferior turbinated bones. Its external coat is fibrous, and its internal mucous; it is larger above than it is below, and opens into the inferior meatus of the nose. The mucous lining forms a semicircular fold or valve.

The muscles: *Levator palpebræ superioris.*[4]—*Origin*, near the optic foramen.. *Insertion*, by a broad aponeurosis into the upper lid. It draws the lid upwards.

The *four straight muscles*, arise around the optic foramen; and are inserted, by tendinous expansions, within a few lines of the cornea. They are called superior,[9] inferior,[13] internal,[10] and external.[11]

The *superior oblique muscle*,[5] arises from the edge of the optic foramen, and plays over a tendinous pulley[6] upon the orbitary ridge of the frontal bone; is inserted into the sclerotica beneath, and beyond the superior rectus.

Fig. 155.



The *inferior oblique*,[8] arises from the nasal process of the superior maxillary bone; and passing below the inferior rectus, is inserted beyond it, into the sclerotica.

### THE EAR.

The organ of hearing is composed of three parts: the External Ear, the Middle Ear, or tympanum, and the Internal Ear, or labyrinth.

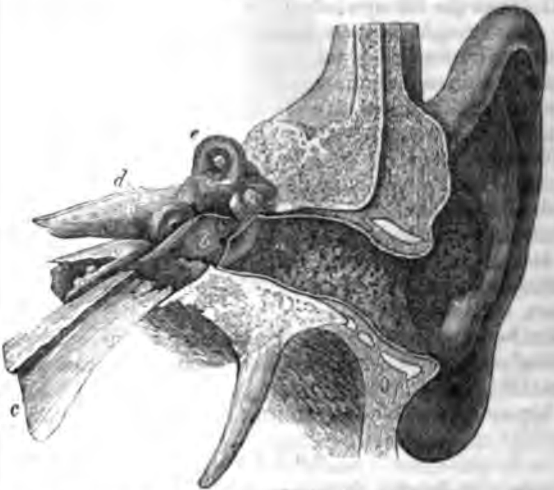
The *external ear* consists of two parts, the *pinna*, which is moveable upon the side of the head, and the *meatus*, a tube leading from it.

The *pinna* has a number of ridges and hollows upon its surface; these are: a prominent rim or *helix;* and within it another curved prominence, the *antihelix*, which bifurcates above, so as to enclose a space, called the *scaphoid fossa*, and surround a deep, capacious, central cup, the *concha*. The space between the helix and antihelix is the *fossa innominata*. At the end of the helix, in front of the concha, is a small detached eminence, the *tragus*, so named from its bearing a tuft of hair, resembling a goat's beard. Opposite this, behind and below the concha, is the *antitragus*. Below is the pendulous *lobe*, composed of dense areolar and adipose tissues. The *concha* is imperfectly divided into an upper and lower part, by the anterior curved extremity of the helix.

The *skin* of the pinna is thin, and contains an abundance of sebaceous follicles.

*fibro-cartilage* is an oval, elastic plate, of a yellowish colour, ich are several fissures filled up with fibrous tissue. It is ed by an *anterior ligament*, which is triangular, broad, and to the zygomatic process, and by the *posterior ligament* to stoid process.

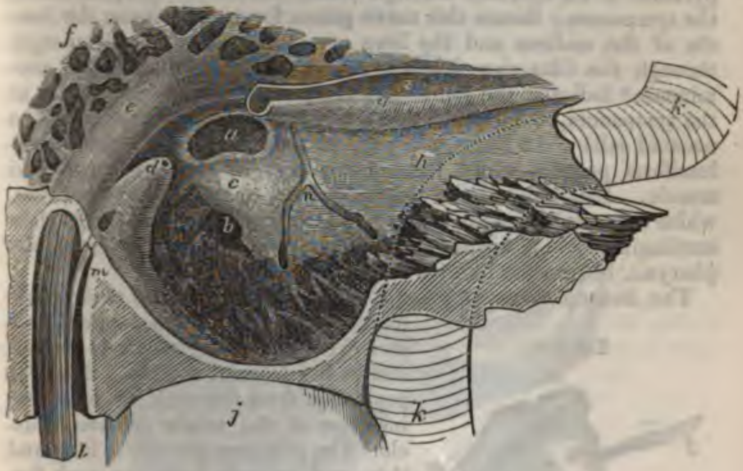
Fig. 156.



muscles which move the pinna as a whole are the *attollens læ*, arising from the aponeurosis of the occipito-frontalis; and ed into the outer side of the cartilage of the ear opposite the id fossa: the *attrahens auriculæ*, arising also from the same rosis in front of the zygoma, and inserted into the forepart helix; and the *retrahens auriculæ*, arising from the mastoid s of the temporal bone, and inserted into the back part of ncha. There are also some small muscles upon the pinna The *major helicis* is narrow, about half an inch long, thin, uated at the arched superior and anterior part of the helix; es are vertical. The *minor helicis* is very small, and situt the inferior and posterior arch of the helix. The *tragicus* ee-cornered, tolerably thick, with vertical fibres upon the . The *antitragicus* is narrow and short, and passes from the gicus to the antihelix. The *transversus auriculæ* is on the ior surface of the ear, extending from the convexity of the to the external part of the antihelix. The *dilatator conchæ* s from the meatus auditorius to the anterior part of the , which it draws forwards, and thus dilates the concha. The *obliquus auriculæ* is upon the internal surface of the ear, between the elevations of the fossa innominata and the concha.

The *meatus*[a] is a cartilaginous and bony canal, of about one inch in length, narrow in the middle, and curved downwards; the skin lining it is covered with hairs, and glands secreting wax.

Fig. 157.



*Membrana tympani.*—The drum of the ear is a thin, semi-transparent, oval membrane, separating the cavity of the tympanum from the external ear. Its internal surface is slightly convex, and attached to the handle of the malleus. It is directed obliquely downwards and inwards, and it consists of three laminæ, the middle of which is strong and fibrous, and attached to the rim of the bone. The external surface is a continuation of the cuticle, and the internal of the mucous membrane, lining the cavity.

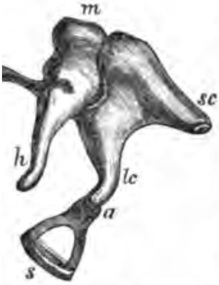
The *middle ear* or *tympanum*[b] is a small, irregular, bony cavity, in the petrous portion of the temporal bone, and bounded in front by the membrana tympani. It is filled with air, which enters by the Eustachian tube;[c] and contains a chain of small bones, and openings into the mastoid cells.

The internal wall of the tympanum has two orifices of communication with the internal ear in the dried bone; the *fenestra ovalis*,[a] an oblong opening leading to the vestibule, and the *fenestra rotunda*,[b] opening into the cochlea; both of these are closed by membrane, which prevents the escape of fluid contained in these inner chambers, and communicates vibrations to it. The fenestra ovalis is also closed by the foot-piece of the stapes. Between the fenestra

ıromontory,[c] an elevation corresponding to the first turn of
hlea, and furrowed with two or three grooves for the nerves
form the anastomosis of Jacobson. The *pyramid*[d] is a small
projection behind the fenestra ovalis, presenting a small
at its summit, through which emerges the tendon of the
us muscle, which is contained within. At the base of the
d is an aperture through which the chorda tympani enters
ıpanum; thence this nerve passes forwards between the han-
the malleus and the long arm of the incus, and emerges
ı the Glaserian fissure. Above the pyramid an arched pro-
e[e] indicates the course of the aqueduct of Fallopius, close to
ıpanum, and behind this is the free communication with the
l cells. At the upper part of the tympanum is the coch-
m process, which bounds the canal of the tensor tympani
Below this is the commencement of the *Eustachian tube*,
s a straight canal, about two inches long, at first bony, then
inous, and opening by a trumpet-shaped orifice into the
x, behind the inferior turbinated bone.

*Bones* of the tympanum are four in number;[1] the *malleus*, or hammer, has a *head*,[m] separated by a *neck* from a *handle*,[h] which is imbedded in the drum of the ear. A slight projection from the neck, receives the insertion of the tensor tympani muscle. The *processus gracilis* is long and thin, and extends from the neck forwards and outwards to enter the Glaserian fissure; to it is attached the laxator tympani muscle. A short conical process projecting from the back of the head, articulates with the incus.

Fig. 158.



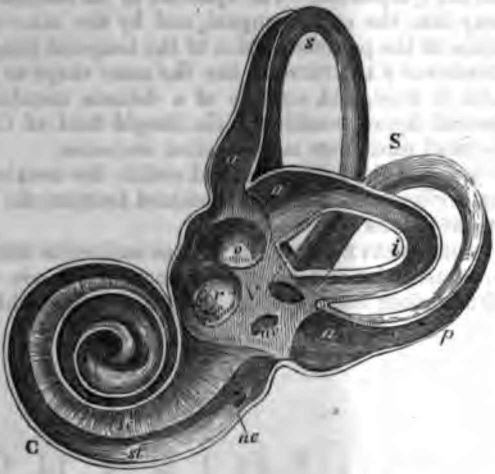
The *Incus*, or anvil, resembles a
ooth. Its body articulates with the malleus. Its *short crus*[sc]
ted backwards, and projects towards the mastoid cells. Its
*ıs*[lc] has a hooked apex, which is bent inwards, and in contact
ımall lenticular bone, called *orbiculare*,[a] which is often fused
ı incus.

*tapes* or stirrup has its base or foot-piece[s] fitting the fenestra
one of its sides is more curved than the other, and its head
ntact with the orbiculare.

*muscles* moving these bones are the *tensor tympani*, ar
e spinous process of the sphenoid bone and from the F
be, and passing through that canal above the Eustachian
serted into the upper part of the handle of the malleus,
ı inward, and thus stretches the membrane of the tymp

The *laxator tympani* arises from the spinous process of the sphenoid bone, and passes through the Glaserian fissure, to be inserted into the processus gracilis of the malleus. There is sometimes another and lesser laxator tympani. The *stapedius* arises from the interior of the pyramid, and its tendon escapes from its summit, to be inserted into the head of the stapes.

Fig. 159.



The *Internal ear*, or *labyrinth*, consists of a bony and membranous portion; the bony labyrinth consists of three parts, the *vestibule* (V), the *semicircular canals* (S), and the *cochlea* (C).

The *vestibule* is a small, three-cornered cavity, behind the internal wall of the tympanum; into it open the semicircular canals,$^{s}$ by five orifices behind, and the cochlea, by a single one in front. On its outer wall is the fenestra ovalis,$^{o}$ and on its inner, several minute holes, including the macula cribrosa, for the entrance of a portion of the auditory nerve. The *aqueduct* of the vestibule also penetrates it, from the posterior surface of the petrous bone. It also contains two depressions, called *fossa hemispherica* and *fossa semi-elliptica.*$^{o}$

*The semicircular canals*$^{s}$ are three curved cylinders of half a line in diameter, whose extremities open into the vestibule by five orifices, each extremity being expanded like a flask and called *ampulla.*$^{a}$ Two of these canals$^{s\,p}$ are vertical, and one is horizontal.$^{o}$ *The cochlea* resembles a snail-shell, and consists of a conical canal, which makes two turns and a half spirally around an axis called the

A

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OLOGY is that science which treats of the actions or func-
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action. [illegible] is one in which all vital action has
and to [illegible] gration of the organized body suc-

[illegible] te of *active life*, exhibits certain pro-
[illegible] and nu [illegible] provided for, and
the dest [illegible] nce of surrounding

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# PHYSIOLOGY.

Physiology is that science which treats of the actions or functions peculiar to living *organised* beings during the continuance of *health*, or *normal* life.

These actions, when they occur in a disturbed or irregular manner, constitute *disease*, or *abnormal life;* and become the subject of the science of Pathology. Every living being is *organized*,—that is, composed of different parts or *organs*, each of which has its definite structure, by which it differs from other parts, and is capable of fulfilling a certain end. The complex matter, which enters into the composition of an organised being, or *organism*, is called organic matter, and is obtained by its proximate analysis. By its ultimate analysis, this matter is resolved into its elementary principles, or inorganic elements, such as constitute other objects in the universe.

The mineral kingdom does not exhibit the same distinctness and variety of structure, in the component parts of its various bodies, nor is there any adaptation of these parts to separate functions; they are, therefore, called *unorganized* or *inorganic*, and are, by chemical analysis, resolved into those simple elements which admit of no farther subdivision.

Organized bodies are found in one of two states or conditions, viz., that of *life*, or *death*. That of life, is a state of action, or of capacity for action. That of death, is one in which all vital action has ceased, and to which the disintegration of the organized body succeeds as a natural consequence.

An organized body in a state of *active* life, exhibits certain processes by which its growth and nutrition are provided for, and which enable it to resist the destructive influence of surrounding agents. The object of these processes, is to promote the development, and to preserve the integrity of the body itself. The simplest animal or vegetable, is an illustration of this remark.

The very processes which denote vital activity, may be sometimes temporarily suspended, even in fully-formed animals and vegetables; and in such instances, life may be said to become *dormant*. Of this we have an example in the ordinary wheel-animalcule, w

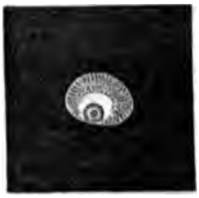
ı apparently killed by the drying up of the fluid in which
een immersed, will speedily renew its active movements on
gain supplied with water.
ıized bodies are capable of being resolved, by chemical
, into the inorganic simple elements; but the list of sub-
obtained from this source, is small in comparison with those
n the inorganic world, being only about seventeen. Of
'our alone, are considered *essential*, viz., carbon, oxygen,
n, and nitrogen. Two, at least, of these will be found in
·ganic compound. The other simple substances are found
er quantities, and are less extensively diffused; these may
d its *incidental*, or *non-essential* elements. These are,
, phosphorus, chlorine, sodium, calcium, potassium, mag-
silicon, aluminum, iron, manganese, iodine, and bromine;
two are obtained almost exclusively from marine plants and
. Between these elementary substances and the *organized*
, or vegetable structure, there exists a class of compounds,
*roximate principles*, or *organic compounds*, or *organizable*
*es*. These are obtained in the first stage of chemical
of the various animal and vegetable tissues, and may be
l by further analysis into their simple elements. For
, by the first analysis of *muscle*, we obtain the *proximate*
*le*, called *fibrine*, which is its chief constituent; subsequently,
analysis of *fibrine*, we obtain the simple elements, oxygen,
n, carbon, nitrogen, and sulphur, in certain proportions.
the other hand, by synthesis, the inorganic elements will
the organic compound fibrine; from which again, the
*structure*, muscle, is obtained. This, however, has never
'ected in the laboratory, but solely in the living body.
true proximate principles are those substances which are
ained by the analysis of the organized textures; such are,
starch, and lignine, from the vegetable; and albumen,
or fibrine, from the animal textures. From these again
ved a great variety of products by various processes, owing
tendency which their elements have to form new combina-
For example: by boiling starch in dilute acids, it becomes
ed into a kind of gum, and starch-sugar. A large class of
compounds is thus formed, which it seems proper to distin-
rom the true proximate principles, under the name of *secon-*
*ganic compounds*.
ıalyzing both the primary and secondary organic elements,
e found, in the majority of cases, to be composed of three
essential elements; although in the secondary organic
f the vegetable class, we meet a few instances of binary
of simple elements.
n an organic substance, which is so constructed as t

part of a living organism, is examined, it is found to possess some very distinctive characters. It contains water in considerable proportion; its form is more or less rounded, and free from angularity, and it is never crystallized. When it is necessary that it should possess considerable hardness, the amount of water is small, and an inorganic material is combined with the organic matter, as the phosphate of lime with gelatine in bones, or the silex with the epidermic tissues, in plants.

An organized body is composed of parts which differ from each other in structure and function; it may be subdivided into a series of textures, each differing from the others in physical and vital properties. When a great variety of textures exist in an animal, it is an indication of a high degree of organization.

The simplest and most elementary organic form, is that of a cell containing another within it (*nucleus*), which again contains a granular body (*nucleolus*). (Fig. 1.) This appears to be the primary form which organic matter takes as it passes from a condition of a proximate principle to that of an organized structure.

Fig. 1.



In some animals and vegetables, the whole body is composed of cells of this kind, and in the development of the embryo, all the tissues, however dissimilar, are composed of cells which are afterwards metamorphosed into the various structures that make up the perfect being.

Every organized body has a definite form and size; it has also its origin from parents, and has an allotted time to live; and after death it passes by decomposition into the simpler combinations of the inorganic elements.

Organized bodies grow by materials which are deposited within, and carried to the different parts of the structure by a vital process. They have also the power of repairing parts lost either by injury or disease. Parts that have been removed, may be replaced by a process of growth in the plant or animal, and this process is the more energetic in proportion as the structure of the organized body is more simple. The part that has been separated, however, in the higher orders, perishes; but in the lower orders, it often happens that the severed portion becomes a new and independent being, as is the case with the hydra, in the animal kingdom, and with certain members of the vegetable kingdom, cuttings of which will often produce a similar plant to that from which it was taken.

Organized bodies have the power of appropriating or assimilating to their own textures, other substances, both organic and inorganic. By virtue of this process, plants and animals are continually adding to themselves new materials by which they are nourished. Plants

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Water is one of the most important of the constituents of the human body; it enters largely into the composition of all the fluids, and gives flexibility and softness to the various solid textures. It is also a solvent of many organic matters, and either in solution, or suspension, serves to carry them to the various textures and organs. As a general rule, the amount of water contained in an organized structure bears a proportion to its vital activity, though, of course, there are exceptions to this rule.

It has been already shown that there exists between the inorganic elements and the organized animal or vegetable structure a class of compounds called *proximate principles*, and that from these a great variety of products could be obtained, owing to the tendency which their elements have to form new combinations, and that these latter were called *secondary organic compounds*. The following table exhibits these two classes of substances.

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their nourishment from the inorganic world, from the excre-
f animals, and from decaying organic matter. Animals, on
her hand, can be nourished only by organic matter, either
or vegetable. Both possess the power of re-arranging the
uents of these substances into forms identical with those of
ments of their various tissues.

whilst new matter is being deposited, the old particles must
wn off, otherwise the growth would be unlimited; and if ex-
alone went on, disorganization would very soon occur. In
perations, new combinations are continually taking place as
, in opposite directions; in the one, from the simple to the
x organized parts; in the other, from the complex constitu-
the textures to the simple organic or inorganic compounds.

n the *decomposition* of animal and vegetable matters, a great
of products results. This decomposition is of two kinds,
uished by the names of *fermentation* and *putrefaction;* the
term has been limited by Liebig to the decomposition of
nces devoid of nitrogen, and the latter to that of azotized
nces. The products of this decomposition are nitrogen and
en (which partly escape in a free state), water, carbonic
arburetted hydrogen, olefiant gas, ammonia, cyanogen, prus-
l, phosphuretted hydrogen, and hydrosulphuric acid; while
e cases the elements reunite in different proportions, so as to
new organic compound, as in the production of sugar from
in the saccharine fermentation. Sometimes from one organic
nce two new compounds are generated, one organic, the other
nic; as in vinous fermentation, during which carbonic acid
ohol are formed from sugar.

conditions more or less necessary for the spontaneous decom-
n of organic matter, are moisture, the access of atmospheric
l a certain temperature. The first and last are always neces-
he second not invariably.

gaseous products of the decomposition of animal matter, and
human body in particular, are carbonic acid, sometimes nitro-
drogen, sulphuretted hydrogen, phosphuretted hydrogen and
ia. Acetic acid is also formed, and sometimes nitric acid.

ontrasting the characters of organized bodies as described,
ose of the inorganic world, the distinction between the two
seen. Inorganic bodies are either aeriform, liquid, or solid;
e irregular in shape, and generally angular. No distinction
s or organs is to be found in the mineral substance; its mi-
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Inorganic bodies are unlimited in size and duration, co
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on and digestion of food; whilst the first processes of vege-
volution tend to the production of a leaf-like membrane,
like the permanent *frond* of the lower classes of plants, ab-
ourishment by its expanded surface only. The seed of the
nd the egg of the animal consist principally of a store of
ment prepared by the parent for the supply of the germ,
is introduced into the midst of it. In both instances, the
velopment of the germ is into a membranous expansion,
bsorbs the alimentary materials with which it is in contact,
epares it for the nourishment of the embryonic structure.
ts, this membranous expansion absorbs by its *outer* surface
hich is applied to the albumen of the seed. In animals, the
on is developed in such a manner, that it surrounds the
n, inclosing it in a sac, of which the inner surface only is
ed in absorption, and becomes the temporary stomach of the
nic structure.

*circulation* is much more simple in plants than in animals,
in them, never provided with a special organ for the distri-
of the sap; they have no heart.

function of *respiration* has usually been enumerated among
tinctive characteristics of animals and plants, it being sup-
hat oxygen is absorbed and carbonic acid evolved by the
and a converse change effected in the surrounding air by
er. This, however, is not correct, the products and process
ration being the same in both; whilst the absorption of car-
cid and elimination of oxygen which take place only in day-
s much more analogous to the *digestion* of animals. Lastly,
having only one mode of manifesting life, namely, by vege-
do not require manifold organs in addition to their roots,
nd leaves, and, with the exception of the organs of fructifi-
present merely a repetition of perfectly similar parts, in all
h the simple relation of branches to leaves is the same, and
e sexual organs are evidently allied to the leaves, and in
ases are transformed into them. In animals, on the con-
he reciprocal action of circulation, respiration, and the ner-
stem is actually necessary to life. The respiratory move-
re dependent on nervous influence; but the nerves do not
his influence unless supplied with blood which has been
in the lungs; and the blood again is not sent to the diffe-
gans, and therefore not to the nerves, unless the contrac-
f the heart are performed; while the heart in its turn is
ent on the influence of arterial blood and the nerves. The
heart, and lungs, therefore, may be likened to
of the animal machine, each acting on the other, a
ion by the change of material which takes place

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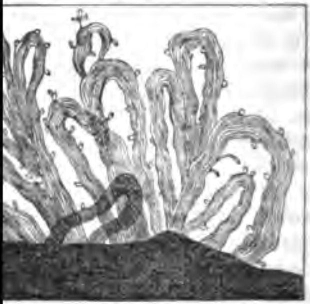
*rine* is found in solution in the chyle, lymph, and blood. It
basis of the muscles, in which it is found in a solid form. It
of the most abundant of the animal substances. It may be
ed by stirring blood as it is flowing, or by washing a clot in
water so as to dissolve out the colouring matter.

rine is white, solid, flexible, and slightly elastic; insoluble in
alcohol, and acids, but soluble in caustic potassa. Chemically
ing, fibrine does not differ essentially from albumen. Physio-
lly, the great variation lies in the *spontaneous* coagulation of
brine, and when coagulated it is found to possess a definite
*s* arrangement, the fibres crossing each other in every direction.
rine is the plastic element of the blood, and with the serum
tutes the liq. sanguinis; it forms the buffy coat of the blood,
found in those exudations which take place either in inflammation, or from a peculiar formative action, destined to repair an old tissue, or produce a new one; under these circumstances, it is often called *coagulable lymph.* (Fig. 2.) This is the commonly-received opinion. In Simon's recent work on General Pathology the following views in opposition to it are strongly supported. The analyses speak for themselves, and if true are destined to give to this organic element a lower posi-
the scale than it has hitherto occupied. This, however, is
e place to discuss the question.

Fig. 2.



ibrine is undiminished by bleeding, however frequently re-
; nay, it often, or even usually, increases under this debi-
g treatment: its highest figure given in Andral's book (10.2)
a fourth bleeding; and Scherer found it as high as 12.7 at
rd venesection in a case of pneumonia. I find that under
other circumstances of exhaustion and weakness and inanition,
the progress of starvation,* during diseases essentially anæ-
uring violent fatigue, and the like, its proportion has been
at least as high, perhaps higher, than in the inflammatory
s. And as in these respects I find its proceeding to be in

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analysing the blood of seventeen healthy horses, Andral and Gavarret found the
m of fibrine to be 5 per 1000; the minimum to be 3; the mean to be 4. In dealing
ased horses, many of them meagre and half-starved, Dr. Frans Simon found this
n increased to 11 or 12 per 1000. In one case, particularly, of experimental star-
a horse, after four days' total abstinence, this observer found that the animal's
n of fibrine had risen from 5 to 9."

direct contrast to that of the red globules (which we know to be potential elements in the blood, and which are at once reduced by bleeding and starvation), so also do I find a similar contrast in another striking particular. Messrs. Andral and Gavarret, in the course of their extensive researches in the comparative physiology of the blood, ascertained that an improvement in the breed of an animal tended always (*cæteris paribus*) to increase the proportion of its coloured blood-corpuscles; they found that the same improvement tended likewise to diminish the proportion of its fibrine. And I find further indications of the same inverse ratio between the fibrinousness and the perfection of the blood, in the facts—that there is little or no fibrine in the blood of the fœtus, none in the egg, none in the chyme, and less in the blood of the carnivora (who feed on it) than in that of the herbivora.

"Some of these facts, derived from very different sources, appear quite inexplicable on the theory that fibrine is essential to the progressive development of the tissues; and the opposite inference seems unavoidable, that it must be considered an excrementitious product, derived from the waste of the tissues or the oxidation of the blood, and in progress of elimination from the system. This conclusion, carried into the domain of pathology, would lead us to suppose, that an augmented proportion of fibrine in the blood (whether occurring in active disease, or within the limits of apparent health) can be taken as an indication only of increased labour and waste in certain elements of the body, not of an increased development in the resources and nutrition of the blood. And on the same ground it would appear that a super-fibrination of the blood, in acute inflammatory diseases, must be regarded as a consequence and effect of those diseases, not as their cause, and not as a primary affection."

Caustic potassa, carb. potass., chloride of sodium, and many neutral salts, when mixed with blood, will prevent the coagulation of fibrine.

*Caseine* has many properties in common with albumen and fibrine. It exists in greatest abundance in milk, and is the basis of cheese. Its occurrence in other fluids has not been positively detected. It may be obtained by allowing milk to remain at rest till it is coagulated, skimming off the cream, then washing and drying the clot.

Caseine is very perfectly coagulated by the action of *rennet*. This coagulating power is not due to the acid of the stomach, but to the pepsine resident in it. It is not coagulable by heat, but is readily precipitated by the addition of an acid. It contains sulphur, but no phosphorus.

*Proteine.*—If albumen, fibrine, or caseine, be dissolved in caustic potassa, and acetic acid be added to the solution, a precipitate takes

f a translucent, gelatinous material. This substance was
*proteine* by Mulder, the discoverer, because it was supposed
ıe starting-point or basis of all the tissues (from πρωτευω, I
ıe first place). Liebig, however, and Fleitmann, deny the
ce of any such substance as proteine, on the ground that
[ulder so called and considered to be formed of none but the
ıl elements, always contains a certain quantity of sulphur, as
umen or other substance from which it was prepared did.
estion is yet undetermined; for since Liebig published his
, Mulder has repeated his own, and maintained that, though
teine prepared as above described does contain sulphur, yet
t in the form of elemental sulphur, but in that of hypo-sul-
s acid. He believes albumen, fibrine, and other principles
group to be compounds of proteine with sulphamid and phos-
, and that in dissolving them in potash-ley, these compounds
omposed with water, ammonia being formed and given off,
ulphurous and phosphorous acids combine with the proteine.
estion must, as yet, be thus left; but there seems sufficient
lity in Mulder's views to justify the received use of the term
*e-compounds*, in speaking of the class, including fibrine,
n, and others to which the name of albuminous compounds
be applied.

precipitate is the same no matter which of the substances
ıamed be taken, be it animal or vegetable. They are looked
ıerefore as modifications of proteine by the addition of cer-
portions of phosphorus or sulphur, or both.

l proteine is a hard, brownish-yellow substance, without
nd insoluble in water and alcohol. It unites with oxygen
ite proportions, so as to form a *binoxide* and *tritoxide.*
re formed in the lungs from fibrine, which in a moist state
es the property of absorbing oxygen. The tritoxide, espe-
is formed every time that the blood passes through the lungs,
en out again when it returns to the system. A much larger
y is formed also during the inflammatory condition, consti-
the *buffy coat.*

*ine* and *Pyine* are also included under the head of proteine-
nds by some authors, although the existence of this substance
ı is denied by many others. The first is a peculiar substance
off from the mucous lining of the stomach, and the second
a peculiar substance found in *pus.* Mulder regards it as a
*de of proteine.* Proteine undergoes decomposition very rea-
hen acted on by other chemical substances, espe
. This is a property which must be continually
ing body; since the blood is known to have ar
.

*tine* is the chief constituent of the cellular, or ar skin, tendons, ligaments, and cartilages: it is also contained in large quantities in bones. It is obtained by boiling any of the above substances, and allowing the solution to cool. Glue is an example of impure Gelatine. It contains *no proteine*, hence it has been concluded that it cannot yield albumen, fibrine, or caseine. It is insoluble in cold water, alcohol, and ether, and has a strong affinity for tannin. The process of tanning leather results from this affinity. Proteine cannot be obtained from gelatine, but it is probable that it or its compounds have yielded gelatine, for the gelatine of the chick must be produced from a compound of proteine.

*Chondrine* resembles gelatine in many respects, except that it is not precipitated by tannin, and yields a precipitate to acetic acid, alum, acetate of lead, and protosulphate of iron, which do not disturb solutions of gelatine. It is obtained by boiling the permanent and temporary cartilages, also from the cornea; and gelatinizes when cool.

*Elaine*, *stearine*, and *margarine* are proximate principles of fat. The first gives fluidity, the second is the solid ingredient, and the third is of medium consistency. Stearine is but sparingly present in human fat.

*Hæmatosine* is the red colouring matter of the blood contained in a capsule which is composed of *globuline*. The latter is regarded by some chemists, as a proteine-compound.

In regard to the *secondary organic compounds*, they are transformed by some unknown chemical agency, from the elements of the tissues, to be excreted from the system by particular organs. There is reason also to believe, that, at least with respect to some of them, the elements of the food contribute immediately to their formation. Of this latter hypothesis the bile is supposed to be an example.

Further, in regard to the particular tissues from which these compounds are formed, Dr. Prout suggests that urea is derived from the gelatinous, and uric acid from the albuminous tissues, whilst the fatty materials are supposed to form some of the constituents of the bile. The particular compounds will be treated of under the head of Secretions.

## CLASSIFICATION OF THE TISSUES.

From the proximate principles described above, are developed the various tissues of the body. In combining to form the different structures, the solids are arranged in a variety of ways. Of these the chief are in filaments, or elementary fibres, tissues, organs, apparatus, and systems. By *filament* is meant the elementary solid. A *fibre* consists of a number of filaments united together. By the union of tissues, *organs* are formed. A number of diffegans united to accomplish one end constitute an *apparatus.* a number of organs of similar or analogous structure are for one end, they form a *system.* Schwann advanced the e that *all* the tissues of the body were formed from *cells.* been shown, however, by subsequent research, that this ɔn was rather too hasty; that, although many tissues retain ɔriginal cellular type throughout life, and many more are from cells which are afterwards metamorphosed, there are ı which no other cell-agency is employed than that concerned elaboration of the plastic material. This is the case in cer- rms of the very delicate structureless lamella known by the of *basement membrane,* found beneath the epidermis and ium, in which no vestige of cell structure can be seen, but appears rather to resemble that of which the cell walls are lves constituted. At other times it seems to be composed coalesced nuclei of cells whose development has been arrested. ırd to the fibrous tissues, a doubt also exists as to whether e developed by a metamorphosis of cells, or whether they , like basement membrane, produced by a consolidation of ic fluid which has been elaborated by cells.

following arrangement of the human tissues, is that adopted Carpenter, and expresses their fundamental relation to the ts above alluded to, viz.: *Membrane, Fibres,* and *Cells.*

imple membranous tissues.—Of these there are scarcely ımples in the human body except in the capsule of the lens, posterior layer of the cornea. The walls of the primary cells are also composed of it; and it is employed in forming , nerve, and the adipose and tegumentary tissues. Its prin- ıaracter is extension, but its ultimate arrangement defies the powers of the microscope.

imple fibrous tissues.—Under this head are included the ınd yellow fibrous tissues and the areolar tissue. These are vely used for connecting different parts, or for associating the ts of other tissues. The ligaments of joints are composed of ıite or yellow fibrous tissues; and areolar tissue surrounds ınects the component parts of nerves, muscles, vessels, &c.

imple cells floating separately and freely in the fluids, as cor- of the blood, lymph, and chyle.

imple cells developed on the free surfaces of the body, as nis and epithelium.

ompound membrano-fibrous tissues, composed of a layer of membrane, developing cells on its free surface, and united other to a fibrous or areolar structure, as the skin, anes, serous and synovial membranes, lining meml ·essels, &c.

imple, isolated cells, forming solid tissues by thei fat cells, the vesicles of gray nervous matter, abso of the villi, the cellular parenchyma of the spleen; the cells being held together in all these cases by the blood-vessels and areolar tissue which pass in between them. In cartilage, and certain tissues allied to it in structure, the cells are united by intercellular substance, either homogeneous, or of a fibrous character.

*g.* Sclerous or hard tissues, in which the cells have been more or less consolidated by internal deposit, and more or less completely coalesced with each other, as the hair, nails, &c. These may be more properly ranked under the epidermic tissues, but the result is more characteristically seen in bones and teeth. The sclerous tissue contains a large proportion of inorganic material to which it owes its hardness. It differs from all the other tissues except cartilage and fibro-cartilage, which for hardness might be classed with it.

*h.* Simple tubular tissues, formed by the coalescence of the cavities of cells, without secondary internal deposit, as the capillary blood-vessels and smallest lacteals and lymphatics.

*i.* Compound tubular tissues, in which, subsequently to the coalescence of the original cells, a new deposit has taken place within their cavities. In the tubuli of the white nervous matter, and in those of the least perfect form of muscular fibre, the secondary deposit has only a granular or amorphous character; but in the striated muscular fibre it is composed of minute cells.

Other classifications of the tissues have been adopted by different physiologists and general anatomists; among these Haller described only *three*, the *nervous*, the *muscular*, and the *cellular*; from these all the organs are formed by the association of the first two tissues, or by the last alone. The limits of a work like this will not admit of an examination of all these different classifications. That one has been adopted which seems to be most generally received.

The elementary membrane was alluded to and described, as far as seemed requisite, in the commencement of this article; we proceed at once, therefore, to the consideration of the second group of tissues,—the *fibrous*.

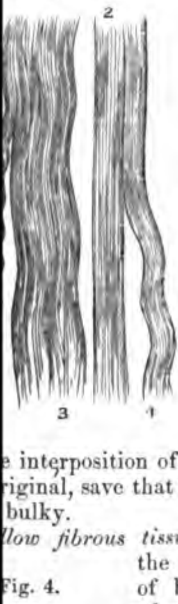
## OF THE SIMPLE FIBROUS TISSUES.

Under this head are included two kinds of texture, resembling each other only in the fact that they present to the eye a *fibrous* aspect. They differ in their ultimate structure, colour and physical properties. They are both used in connexion with the skeleton, and are concerned in the mechanism of animal motion and locomotion. They are known as the *white* and *yellow fibrous tissues*.

It will be remembered that there is reason to doubt whether they are generated by a metamorphosis of cells, or whether they are not produced by the consolidation of a plastic fluid which has been elaborated by cells; the latter is the more probable hypothesis.

*white fibrous tissue* is found in textures requiring great flexi- strength, and an unyielding firmness; such as ligaments, tendons, fibrous membranes, aponeuroses, &c. It presents itself in the form of inelastic bands, somewhat wavy in their direction, sometimes arranged side by side, at others disposed on different planes and interlacing and crossing in various directions. (Fig. 3.) It is *inelastic*, and under ordinary circumstances, *inextensible;* contains but few vessels, and no nerves, at least they have never been satisfactorily discovered. It seems entirely destitute of any vital properties; and its chemical nature is such that it needs very little interstitial change to maintain its normal composition. It yields gelatine in considerable quantity by boiling. When treated with acetic acid it immediately swells up and becomes transparent.

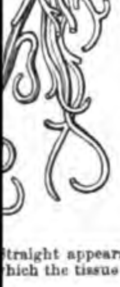
Fig. 3.*



When a solution of continuity takes place in this tissue it is readily repaired e interposition of a new substance, in every respect resembling riginal, save that it wants the peculiar glistening aspect, and is bulky.

*llow fibrous tissue*, differs from the last in colour, and in the possession of *great elasticity*. It consists of bundles of fibres covered by a thin sheet of areolar tissue; the fibres are either round or flattened, brittle and disposed to curl at the end. (Fig. 4.) It is found in the middle coat of the arteries, in the chordæ vocales, the ligamentum nuchæ, the ligamenta subflava, in the crico-thyroid membrane, and in the longitudinal bands of the trachea and its branches. It undergoes little or no change by boiling, and is unaffected by acetic acid; it resists putrefaction, and preserves its elasticity during a long period.

Fig. 4.



Both these varieties may be detected in the tissue now generally designated as *areolar*, formerly *cellular*. This is formed by the crossing and interlacing of minute fibres and bands interwoven in every direction, so as to leave innumerable interstices which communicate with each other: this may be proved by filling them with air or

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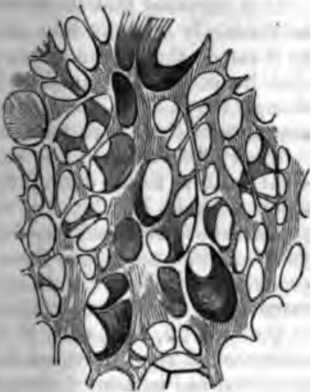
traight appearance of the tissue when stretched. 1, 3, 4, 5. Various wavy appear- hich the tissue exhibits when not stretched.

water, as occasionally happens in the living body in anasarca and traumatic emphysema. (Fig. 5.)

These interstices are not cavities possessed of definite limits, because they are open on all sides. The application of the term *cell* to them is, therefore, inappropriate. The term *cellular* is more applicable to those tissues which consist of a congeries of distinct cells.

Fig. 5.



The *areolar* tissue is one of the most extensively diffused of all the elements of organization, being found in every part of the fabric, except in the compact portion of bone, teeth and cartilage. It does not exist in the brain either, except around the minute vessels. Its great use is to connect together organs and parts of organs which require a certain degree of motion upon each other. To do this, it is placed in their interstices, and is more or less lax, and more or less abundant, according to the particular exigency of the part.

It has scarcely any *vital* properties, but possesses the physical properties of extensibility and elasticity. It has neither contractility nor sensibility, the nerves which it contains, being merely distributed in it in their route to other organs.

Areolar tissue is readily regenerated when destroyed, and yields gelatine very readily by boiling. The interstices are filled during life with a fluid resembling dilute serum, which soaks out of the blood-vessels by *transudation;* a morbid increase of this fluid occasions the condition called *anasarca*, which is recognised by the skin pitting under the pressure of the finger.

## SIMPLE CELLS FLOATING IN THE ANIMAL FLUIDS.

Of these we have examples in the corpuscles of the *blood*, *chyle*, and *lymph*. The corpuscles of the blood consist of an investing capsule composed of *globuline*, and a contained fluid, secreted in the interior of the cell, of a red colour, called *hæmatosin* or *hæmatin*. In shape they are somewhat disk-like, the sides are concave, and there is a bright spot in the centre, which by many has been regarded as a nucleus. The form of the disk is readily altered by reagents, the membrane of the cell-wall being readily permeable by liquids either inwards or outwards, as the relative density of the

ɔn and digestion of food; whilst the first processes of vege-
volution tend to the production of a leaf-like membrane,
like the permanent *frond* of the lower classes of plants, ab-
ourishment by its expanded surface only. The seed of the
ınd the egg of the animal consist principally of a store of
ıment prepared by the parent for the supply of the germ,
is introduced into the midst of it. In both instances, the
ɜvelopment of the germ is into a membranous expansion,
ıbsorbs the alimentary materials with which it is in contact,
epares it for the nourishment of the embryonic structure.
ıts, this membranous expansion absorbs by its *outer* surface
hich is applied to the albumen of the seed. In animals, the
.on is developed in such a manner, that it surrounds the
n, inclosing it in a sac, of which the inner surface only is
ıed in absorption, and becomes the temporary stomach of the
ınic structure.

*circulation* is much more simple in plants than in animals,
in them, never provided with a special organ for the distri-
of the sap; they have no heart.

function of *respiration* has usually been enumerated among
tinctive characteristics of animals and plants, it being sup-
that oxygen is absorbed and carbonic acid evolved by the
and a converse change effected in the surrounding air by
er. This, however, is not correct, the products and process
ıration being the same in both; whilst the absorption of car-
cid and elimination of oxygen which take place only in day-
s much more analogous to the *digestion* of animals. Lastly,
having only one mode of manifesting life, namely, by vege-
do not require manifold organs in addition to their roots,
nd leaves, and, with the exception of the organs of fructifi-
present merely a repetition of perfectly similar parts, in all
:h the simple relation of branches to leaves is the same, and
ıe sexual organs are evidently allied to the leaves, and in
ases are transformed into them. In animals, on the con-
he reciprocal action of circulation, respiration, and the ner-
,stem is actually necessary to life. The respiratory move-
ıre dependent on nervous influence; but the nerves do not
:his influence unless supplied with blood which has been
in the lungs; and the blood again is not sent to the diffe-
gans, and therefore not to the nerves, unless the contrac-
f the heart are performed; while the heart in its turn is
ent on the influence of arterial blood and the nerv
heart, and lungs, therefore, may be likened to
of the animal machine, each acting on the other,
ion by the change of material which takes place

the other hand, as they are found most abundant in those classes of vertebrata which possess the highest temperature, and are known to undergo important changes in the pulmonic and systemic capillaries,—it seems highly probable that their office is, to convey oxygen into the system, and carbonic acid out of it; serving, in fact, as the medium for bringing the tissues into relation with the air, the influence of which is necessary for the maintenance of their vital activity.

A peculiar condition of the red corpuscles in inflammatory blood —a condition which appears to exist naturally in the blood of horses—is the principal cause of the formation of the buffy coat. It gives them a great tendency to adhere together in rolls or columns, like piles of coins, and then, very quickly, these rolls fasten together by their ends, and cluster; so that, when the blood is spread out thinly on a glass, they form a kind of irregular network, with crowds of corpuscles at the several points corresponding with the knots of the net. Hence, the clot formed in such a thin layer of blood looks mottled with blotches of pink upon a white ground: in a larger quantity of such blood, as soon as the corpuscles have clustered and collected in rolls (that is, generally in two or three minutes after the blood is drawn), they begin to sink very quickly; for in the aggregate they present less surface to the resistance of the liquor sanguinis than they would if sinking separately. Thus quickly sinking, they leave above them a layer of liquor sanguinis, and this coagulating forms a buffy coat, the volume of which is augmented by colourless corpuscles, which have no tendency to adhere to the red ones, and by their lightness float up clear of them.

Besides the cells which have been described as floating in the blood, viz., the red corpuscles, there are also found, both in this fluid and in the *chyle* and *lymph*, certain *colourless* corpuscles which are observed to be present in the blood, both of the vertebrata and invertebrata. From the latter fact it would not be wrong to infer that the function of the latter must be of a *general* character, and immediately connected with the nutritious properties of the circulating fluid, whilst the function of the red corpuscles must be of a limited character, being required only in a portion of the animal kingdom. The dimensions of these corpuscles are nearly constant throughout the different classes of vertebrata; their diameter being seldom more than 1-3000th of an inch; hence it would seem improbable that the one would ever be converted into the other. They have no distinct nucleus, but are studded with minute granules, which may occasionally be seen in active motion within them, and which are discharged when the corpuscles are treated with liq. potassæ. In the circulating blood, they are always found on the *outside* of the current, where the motion of the fluid is slow.

*function* of these colourless corpuscles, both in the blood
the chyle and lymph, seems to be, the *elaboration of plasma*
*norganizable albumen.* They are always found most abun-
iere this process is going on, in the fluids in which it is con-
and their number is always in proportion to the *amount of*
material. They are looked upon as cells of a transitional
er, precisely such as those developed in the germinal vesicle
elaboration of its contents. They are not in themselves
d to form an integral part in any permanent structure, but,
taining a certain maturity, reproduce themselves and disap-
iccessive generations thus following each other until the end
nplished for which they were first produced.

## OF CELLS DEVELOPED ON FREE SURFACES.

hese we have examples in the cells composing the *epidermis*
*ithelium*, two structures which are essentially alike in their
mode of development, situation, and individual history; they
iowever, in the purposes which they respectively serve in the
y.

epidermis is the cellular covering of the external surface,
thelium is the corresponding covering of the internal cavi-
They both consist of cells, which are developed from the
nt membrane, which are nourished by its vessels, and which
er a time, cast off from its free surface, to be replaced by a
ing generation.

*epidermis* is not permeated by either vessels or nerves, but
solely in a congeries of nucleated particles arranged in la-
Those that lie deepest and rest immediately on the cutis
ll granules scattered in a homogeneous matrix. Those of
t layer are rounded cells of transparent membrane, in which
granules can be seen. In the succeeding layers these cells
re and more compressed as they are nearer to the surface;
the surface they are mere flattened scales.

superficial scales are being constantly shed; and new ones
onstantly formed below from germs, which are supplied by
ement membrane. The soft layer immediately in contact
e true skin was formerly called *rete mucosum*, but it is now
to consist of the same elements with the ordinary epidermis.
dermis varies in thickness in different parts, according to the
of pressure or friction to which it is subjected.

*use* of the epidermis is to protect the true skin from mecha-
ijury, and from the irritating effects of exposure to atmo-
vicissitudes.

d up with the epidermic cells, we find the *Pigment cells*,
hich contain the peculiar colouring matter of the races.
olour is caused by the presence within them of a num

flat or oval granules, which are transparent, and exhibit an active movement when set free from the cell. The chemical nature of this pigment is unknown; it includes, however, a larger proportion of carbon than most other organic substances—every 100 parts containing 58½ of carbon.

Exposure to light increases the development of these pigment cells, as is seen in freckles, tan, and the swarthy hue obtained by exposure in tropical climates. The latter is doubtless the cause of the blackness of the negro's skin, operating through successive generations.

The *nails* and *hairs* are also modifications of epidermic cells—for *description of which see Anatomy.*

The *epithelium* is the layer of cells which covers the internal free surfaces of the body. In some instances it serves, as in the epidermis, to protect the subjacent membranes; in others, it takes an important part in some of the organic functions. Of all the different forms of organic cells, the epithelium cells are probably most rapidly reproduced; it is supposed by some observers that a complete *cast* of the mucous membrane of the alimentary canal is thrown off every 24 hours, whose constitution is entirely of cells. These cells are invariably replaced by others.

In the arrangement of the epithelial cells, two principal forms are seen, viz.: the *tessellated* or *pavement-like epithelium;* and the *cylindrical*, or *cylinder epithelium.*

The tessellated, covers the serous and synovial membranes, the lining membrane of blood-vessels, and the ultimate follicles or tubuli of the glands connected with the skin or mucous membranes. It is called *tessellated*, from the fact, that the cells which compose it are polygonal, and arrange themselves like the pieces of marble in a tessellated pavement. Sometimes, however, the cells retain their rounded form, and are separated by considerable intervals (Fig. 6).

The *cylinder epithelium* is so called because the component cells are cylinders, and arrange themselves side by side, one extremity resting on the basement membrane, while the other forms part of the free surface. It is found in the mucous membrane of the alimentary canal, from the cardiac orifice downwards; in the larger ducts of the glands which open into it; or, upon the external surface.

Both these forms of epithelium are frequently seen to be fringed at their free extremities with delicate filaments, termed *cilia*, from their resemblance to an eyelash. These, although exceedingly minute, are of great importance in the economy, through the extraordinary motor power with which they are endowed (Fig. 7). In form the cilia are usually a little flattened, and tapering gradually from base to point. Their size is variable, ranging from 1-5000th to 1-13000th of an inch in length.

ɜn in motion they present the appearance of a field of wheat hich the wind is blowing, first depressed, and then return- its original state. The direction of this motion is towards tlets.

Fig. 6.*

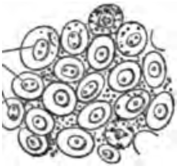
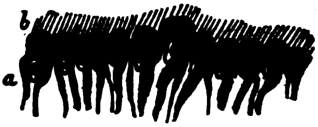


Fig. 7.†



*cause* of ciliary motion is unknown; it is not dependent on lar action, since it continues after separation, and contains en a fibrilla of muscle. It seems to be entirely *molecular* dependent of muscular influence, and of both the vascular ervous systems. It continues many hours after separation he rest of the system has taken place, and when all supply of to the parts endowed with it has been cut off. It resists the of narcotics, which affect powerfully the nervous system; ven electricity, which destroys muscular contractility, does fect the action of cilia. It continues much longer in cold- d than in warm-blooded animals. The *function* of the cilia to be, to propel the secretions, which would otherwise accu- : on these membranes, towards the outlets. In some of the animals cilia are found in the interior of the blood-vessels; se they are the active agents in carrying on the circulation, ɔod corpuscles being carried from one to another, as the secre- ıre in other parts of the mucous membrane.

se cilia have also been called *vibrillæ*, a name which much expresses their function.

epithelium cells, like the epidermic, are being constantly f and renewed from the subjacent surface; but the rapidity ; renewing process varies according to the particular function part.

OF THE COMPOUND MEMBRANO-FIBROUS TISSUES.

; division includes the structures made up of the elementary nents of the body, viz.: membranes, fibres, and cells, in simplest forms. These are the serous, synovial, and mucous ranes.

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ɪment-Epithelium of the Mucous Membrane of the smaller bronchial tub ith double nucleoli.

ucleated cells resting on their smaller extremities; b. Cilia.

The serous and synovial membranes are essentially alike in their minute structure. On their free surface is a single layer of *epithelium*, the particles of which are polygonal in shape, and of transparent texture. This rests upon a continuous transparent *basement membrane* of extreme tenuity. Beneath this is a layer of *areolar tissue*, which constitutes the chief thickness of the membrane, and gives it its strength and elasticity. This areolar tissue is traversed by a network of capillary vessels, lymphatics, and nervous filaments in varying number; and is the bond of union with the tissues beneath. It is commonly known as the *subserous tissue*.

The physical and vital properties of serous membranes are precisely those of areolar tissue. They are elastic, but not contractile, and have very little sensibility, except when inflamed. They are bedewed with a secretion which resembles the serum of the blood. That of the synovial membranes and bursæ mucosæ has from 6 to 10 per cent. of additional albumen. It escapes from the blood-vessels by simple *transudation*.

Serous membranes are recognised by the fact, that they always form shut sacs. The peritoneum of the female is the only exception to this rule. At two points this membrane is open, where it communicates with the canal of each Fallopian tube at its dilated extremity.

The *mucous membranes* may be said to consist of the three parts described in the serous, viz.: *epithelium*, *basement membrane*, and the *submucous areolar* tissue. The mucous membrane is continuous with the external skin, and by some is considered as identical. It is recognised by the fact that it lines the *outlets*, and never occurs as a shut sac. It is abundantly supplied with blood-vessels, absorbents, and nerves. The first two are very numerous, the last not so much so, hence the sensibility of this structure is usually low.

The areolar tissue of mucous membranes usually makes up the greater part of their thickness; and is so distinct from the subjacent layers as to be readily separated from them. The elasticity of these membranes is dependent upon the presence of the yellow fibrous tissue in the areolar tissue.

Mucous membranes are very speedily regenerated whenever they have been destroyed either by injury or disease. They constitute the medium through which all the changes are effected that take place between the living organism and the external world.

The character of the secretions of mucous membranes varies in almost every part, and is dependent upon the properties of the epithelial cells which cover them. In the ultimate tubuli of glands, these cells are found to contain the peculiar substances which characterize the secretion. They are not mere protective agents, as the epidermic cells are, but, in the case of the glands, they are con-

in elaborating their peculiar secretions, and in the mucous
ane of the small intestine, in effecting the absorption of nu-
naterials.

he bronchio-pulmonary and gastro-intestinal mucous mem-
we meet with the peculiar secretion called *mucus*, which is
d to lubricate the parts on which it is thrown out, and to
them from the action of irritating substances. It is also
n the ducts of glands, and in the urinary and gall-bladders,
generally mixed with the secretions of these parts.

us is a viscid, colourless, or slightly yellow fluid, not misci-
h water, and containing a substance called *mucin*, upon which
racteristic properties depend. This appears to be an albu-
compound, altered by the presence of an alkali. Mucus
s, also, a small proportion of solid matter, and some salts,
ling those of the blood and epithelial scales, together with
r corpuscles called *mucus corpuscles.* The true chemical cha-
of this fluid are as yet incompletely known.

## SIMPLE ISOLATED CELLS, FORMING SOLID TISSUES BY THEIR AGGREGATION.

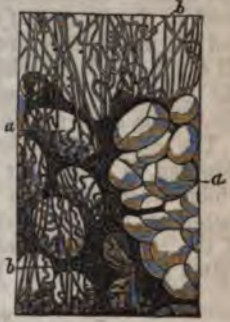
cells of this class begin and end their lives as such without
oing any transformation, but instead of lying upon free sur-
r being cast off from them, they form part of the substance
fabric. Two examples of this kind are found in the cells de-
l at the extremities of the intestinal villi, and those which
t the terminal extremities of the hepatic ducts. Both these
cells seem to have the power of *selecting* from the fluids
ed to them certain materials, which they deliver up to the
nts in one case, and the hepatic duct in the other. An ana-
set of cells are found at the extremities of the fœtal tufts in
centa, which have a like power of selecting nutritious mate-
om the maternal blood for the nourishment of the fœtus.

*fat-cells*, of which adipose tissue is composed, also perma-
exhibit the original type of structure in its simplest form.
ssue is usually diffused over the whole body, either in the
tissue, or in small clusters covered by the common envelope;
en in cases of great emaciation there is some fat always left,
lly at the base of the heart, around the great vessels, &c.

cells are spherical or spheroidal; when closely pressed to-
they assume a polyhedral form. Large masses of fat are
ormed by their aggregation, the component parts being held
r by areolar tissue, and also by the blood-vessels
minutely among them, forming a capillary netw
allest lobules, and even between the individual cel
contains neither lymphatics nor nerves. (Fig. 8.)

The *fat* is contained in the interior of these cells, where it is deposited from the blood-vessels. Its consistence varies according to the proportion of the organic elements entering into its composition. These are elaine or oleine, stearine, and margarine; the last two, which are solid when separated, being dissolved in the former at the ordinary temperature of the body. The oil thus formed in the interior of the cells is prevented from escaping, by the moistening of the cell-walls by the watery fluid circulating through the vessels. All the substances above named are regarded by chemists as *salts*, being compounds of the oleic, stearic, and margaric acids with a base, called, from its sweet taste, glycerine.

Fig. 8.*



The fat is analogous to the starch of vegetables, and has a like use, viz.: to supply elements of nutrition, when other sources are cut off. It also answers the important purpose of retaining the animal temperature by its non-conducting properties; and the still more important object of serving as a kind of reservoir of combustible matter against the time of need. Fat appears to be deposited only when an excess of non-azotized alimentary matter is introduced into the body, over and above the wants of the system.

*Cartilage* in its simplest form consists merely of nucleated cells, and greatly resembles the cellular tissue of plants. In other forms, however, the cells are imbedded in an intercellular substance, or *matrix*, called *chondrine*. This substance bears a strong resemblance to gelatine, but requires longer boiling in water to effect its solution. It is not precipitated by tannic acid, but *is*, by acetic acid, alum, acetate of lead and proto-sulphate of iron. It agrees more nearly with the proteine-compounds in composition, than gelatine, and may be considered as an intermediate stage between the two.

Cartilage, in general terms, may be considered a *non-vascular* substance, considerable masses of it existing unpenetrated by a single vessel. They are, however, surrounded by numerous blood-vessels, which form large *ampullæ*, or dilatations at their edges, or on their surfaces, from which they derive their nourishment by imbibition.

Cartilage is insensible; neither nerves nor lymphatics can be traced into its substance, and it is doubtful whether it is ever replaced by a similar structure when once destroyed.

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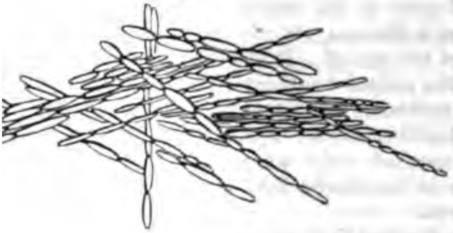
* Areolar and Adipose tissue; *a*, *a*, fat-cells; *b*, *b*, fibres of areolar tissues.

*o-cartilage* is a compound of white fibrous tissue and carti- varying proportions. When the intercellular substance as- a fibrous arrangement, surrounding the cells, it is known by me. In some instances the fibrous structure is developed so t the expense of the cells, that the latter disappear altogether, whole structure becomes fibrous. This structure is seen in se cartilages which unite the bones by synchondrosis, as in tebral column and pelvis. The *reticular* structure is seen in cha auris and in the epiglottis.

*cornea*, according to the researches of Messrs. Todd and n, is a peculiar modification of the white fibrous tissue, in the fibres, which in the sclerotic have been densely interlaced, out into a membranous form, so as to follow the curvatures cornea, and constitute a series of more than sixty lamella, to one another by delicate processes extending from one to the other. The resulting areolæ lie in superposed planes, the contiguous ones of the same plane being for the most part parallel, but crossing those of the neighbouring planes at an angle, and sel- mmunicating with them. (Fig. 9.)

Fig. 9.



*crystalline lens* has long been known to be fibrous. The re united into laminæ by means of numerous teeth or sinuosi- their edges which lock into one another. They originate in everal of which coalesce to form one. After the lens is fully it is not permeated by blood-vessels; these being confined capsule. It consists chiefly of albumen in its soluble form, coagulated by heat. The latest analyses represent the sub- of the lens as consisting of that modification of albumen globuline. The *vitreous humour* is an example of a very rm of cellular tissue. The cells have no open communica- th each other, and contain a fluid holding a small quantity men and saline matter in solution. It is nourished by the which are minutely distributed upon its general surface, eing none distributed through its substance for this purpose.

## S CONSOLIDATED BY EARTHY DEPOSIT.—BONES AND

a full description of these tissues, see ANATOMY. A Teeth.

## SIMPLE TUBULAR TISSUES.

Of these we have examples in the smaller capillary vessels, and probably also in the smallest lymphatics and lacteals. They seem to be formed by a coalescence of the cavities of the cells, produced by the absorption of the cell-walls at the point of contact.

In all the higher animals, in their adult condition at least, the capillary circulation is carried on through tubes having distinct membranous walls. These tubes are formed from cells, like the straight and anastomosing ducts of plants. In the walls of these tubes cell-nuclei may be constantly found; and these are too far apart to warrant the idea, that they are the nuclei of epithelial cells, such as line the larger vessels.

These vessels have a claim to be regarded among the elementary parts of the fabric, since they are formed independently of the larger trunks, and have little in common with them in function. All those changes which take place between the blood and surrounding parts, by which nutrition, secretion, and respiration are accomplished, occur during the movement of the blood through these vessels, the larger vessels merely bringing to them a constant supply of fresh blood, and conveying from them that which has been impoverished in the foregoing processes.

The diameter of the capillaries varies in different animals according to the size of the blood-corpuscles. Thus, they are larger in the frog than in man, in whom they average from 1-3700th to 1-2500th of an inch. In the living subject, it may be stated, they may be seen to vary their diameter at different times, so as to accommodate themselves to the varying supply of blood. They seem to have a distributive power of their own, entirely independent of the heart's action, but influenced by the attraction existing between the tissues and the constituents of the blood. The capillary vessels are first formed in the *vascular layer* of the germinal membrane, entirely by the coalescence of cells, which send off prolongations in various directions, like the radii from a star. By the junction of these prolongations a network of tubes is formed, at first, irregular in size, but afterwards becoming more equalized.

In newly-forming tissues, much the same arrangement takes place, the prolongations coming in contact with the vessels of the surrounding parts.

The opinion, that the *white tissues* are nourished by vessels conveying white blood is no longer tenable. Some of the white tissues, such as cartilage, are entirely destitute of vessels; and in others the supply of blood is so scanty, as not to communicate to them any decided hue. What have been considered as white vessels, are merely those of very minute size, which, admitting only a single row of blood corpuscles, do not contain a sufficient amount of colouring matter to affect the light transmitted through them.

## COMPOUND TUBULAR TISSUES.

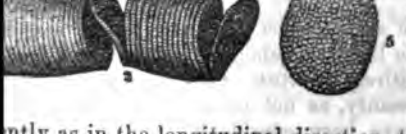
mples of these are seen in the *muscular* and *nervous* tissues,
ch, after tubes have been formed by the coalescence of the
heir interiors are filled up with a secondary deposit. The
ons of these two tissues are widely different. The *muscular*
by which all the sensible movements of the body are effected.
*ervous* is that by which sensations are received; and by which
stincts, emotions, or volitions excited by these sensations, act
he muscles.

ultimate structure of these two tissues is alike; both consist
*s* formed by the coalescence of cells. The difference between
exists in the nature of the internal deposit.

re are two forms of muscular tissue,—in one the ultimate
are marked by transverse striæ, or bands; in the other, they
in, or unstriped. The former, or the striped fibres, are found
the voluntary muscles, or, as they are sometimes called, the
es of animal life. The latter are seen in those muscles which
ncerned in the organic or vegetative functions. They are not
dily called into action through the agency of the nervous sys-
s the striped muscles, but are more readily excited by stimuli
d directly to themselves.

ordinary muscle is seen, even by the naked eye, to consist of
es of fibres, arranged with great regularity, in the direction in
the muscle is to act. These fibres are arranged in *fasciculi,*
ndles, connected together by means of areolar tissue. Each
resents two sets of markings, or striæ, one set *longitudinal,*
her *transverse.* By close examination the individual fibre may be separated into fibrillæ by the splitting of its contents in a longitudinal direction. (Fig. 10.) These fibrillæ present a *beaded* appearance, caused by the peculiar arrangement of the contents of the tube.

Fig. 10.*



It frequently happens, that when force is applied to a fibre, its contents separate in the direction of the transverse striæ, quite as
ntly as in the longitudinal direction, thus forming a series of

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ongitudinal cleavage. 2, 3, 4. Transverse cleavage, forming disks. 5. A detached
wing the sarcous elements. 7, 8. Separated fibrillæ, showing the beaded enlarge-

*disks* as seen in fig. 10. If a general disintegration took place along all the lines in both directions, there would result a series of particles, which have been called *primitive particles*, or *sarcous elements*, the union of which constitutes the mass of the fibre.

According to the opinion of Messrs. Todd and Bowman (in which they are supported by Müller, Lauth, and Schwann), the cross-stripes of the fibres are formed by the apposition side by side of the dark points seen on the separated fibrillæ.

The elements of the muscular fibre are held together by a tubular sheath adapted to its surface and adhering to it; this is called the *sarcolemma*, or *myolemma*. It is a transparent, very delicate, but tough and elastic membrane, which isolates the fibre from all other tissues. It has nothing to do with the production of the transverse striæ. Neither is it perforated by nerves or blood-vessels.

Muscular fibres are rather polygonal than cylindrical, owing to the pressure to which they are subjected by juxtaposition. Their average diameter in man is about 1-400th of an inch, being rather larger in the male than in the female.

The fibrillæ, when examined, are found to present an alternation of dark and light spots, corresponding with the transverse striæ of the fibre, and the lighter intervals between them. Each dark spot is surrounded by a pellucid border; the whole constitutes a complete, though minute cell, and the entire fibrilla may be considered as *made up* of a linear aggregation of such cells. The dark spot within the bright border is the cavity of the cell, filled with a refracting substance. When the fibrilla is relaxed, the longitudinal diameter of these cells is greatest; when contracted, the transverse. Thus the act of muscular contraction seems to consist in a change of form in the cells of the ultimate fibrillæ, consequent upon an attraction between the walls of their two extremities or their nuclei. This corresponds with the contraction of certain vegetable tissues, the component cells of which change their form when irritated, and thus produce a movement.

When muscular fibre contracts, therefore, it is not thrown into zigzag lines, since fibres in this state, cannot be supposed to exercise any force of traction, but it is shortened in length by the approximation of its elements, at the same time that the transverse diameter is increased.

Muscles grow by an increase, not of the *number*, but of the *bulk* of their elementary fibres; the number of fibres probably remains the same through life, as it was in the fœtus. Notwithstanding the energy of its growth, and the constant interstitial changes, it is doubtful whether muscular tissue is ever regenerated where loss of substance has taken place. It is generally replaced by areolar tissue, which gradually becomes condensed, but never *contractile*.

The great property of muscular tissue is that of *contractility*, by

is meant, *the power of moving responsive to irritation.* It is
mere mechanical power by which elastic substances shorten
lves on the removal of a distending force, but it is an endow-
esponsive to appropriate stimuli, and diminishing or disap-
with the healthy state of the tissue. Elasticity is a mere
l property. Contractility is a *vital* property.

tever is capable of inducing contraction in muscles, when
to them, is called a stimulus. Chemical agents, mecha-
pplications, and irritating substances are included under this
In the living body the ordinary stimulus exciting con-
n is the *nervous influence.* Muscular contraction, however,
*dependent* on this influence, since it can be excited after all
ion with the nervous centres has been destroyed, and even in
e isolated fibrilla.

contractility of a muscle may be exhausted by repeated exer-
well as by the continued application of any of the above
, but it may be recovered again, provided a sufficient interval
be afforded to it. "In regarding contractility, therefore, as
rty of living muscular fibre *in general,* it is meant that it re-
n it as a property, without which it would not be muscle;
such a manner, that no particle, however microscopic, can be
d from a muscle which does not of itself, and independently
rest, possess this property as long as it possesses vitality."

cles are abundantly supplied with blood-vessels and nerves.
pillary vessels ramify in the spaces between the fibres, but
enetrate the sarcolemma, the nutritive materials being proba-
plied by the selecting power of cells. The nerves are *motor*
and they are exceedingly abundant, terminating usually in
stance of the muscle *in loops.* The muscles of *organic* life
t little influenced by nervous power, but depend for their
tion upon the presence of substances brought immediately
ntact with them. The muscles therefore have but little
lity.

y fibre of striated muscles is attached by its extremities
e fibrous tissue; through the medium of which it exerts its
tile power on the bone, or other substance to be moved; the
f all these white fibres constitutes the *tendon.* The muscu-
e ends by a perfect disk, and with the whole surface of this
e tendon is connected and continuous with it and the sarco-

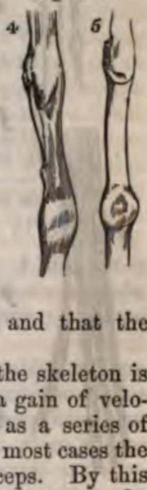
cular contraction is accompanied by the production of *sound*
*at,* both of which are probably produced by the movements
neighbouring fibres upon each other. The heat may
ed by the chemical changes resulting from the disi
muscular tissue consequent upon its use. This el
ature is sometimes as high as 2° Fahr.

*rigor mortis*, or the stiffening of the body to the contraction of the muscles, and, like the coagulation of the blood, is the last act of their vitality. Where the individual has died of a wasting disease, it comes on early, and lasts but a short time, and the reverse obtains where death has occurred during full health. As the rigor mortis comes on, the contractility of the muscle departs. Its cause is obscure, and may be complex, but its resemblance to the contraction of fibrine after recent coagulation is strongly marked.

The muscular fibres of *organic life* are very different, not only in structure, but also in function, from those already described. They consist of a series of tubes, which are not marked by transverse lines, and in which the longitudinal striæ are very faint. These tubes are usually much flattened, and cannot be shown to contain distinct fibrillæ. They are generally smaller than those of animal life, and sometimes present markings indicative of a granular deposit. The nodosities upon their surface are the nuclei of their original components. (Fig. 11.) The peculiarity of these fibres is, that they are very little subjected to nervous influence, and that when stimulated to contraction by an irritant, they perform a series of vermicular movements gradually decreasing in intensity till perfect rest takes place. They are found in the intestinal canal, ducts of glands, middle coat of the arteries and bronchial tubes, &c.

In every case muscular action must alternate with intervals of rest. It is in these intervals that the reparation of the disintegrated tissue takes place, and that the muscle recovers its contractility.

Fig. 11.*



The mechanical arrangement of the muscles upon the skeleton is usually accompanied with a loss of power, but with a gain of velocity. The locomotive framework may be regarded as a series of levers, of which the fulcrum is generally a joint. In most cases the muscles are attached near the fulcrum, as in the biceps. By this arrangement a contraction of a single inch in the muscle, moves the hand through the extent of a foot, but then the hand moves only with one-twelfth of the power exerted by the muscle.

The *Nervous structure* as it appears in the nervous trunks is another example of the tubes with a secondary deposit. This is seen in the *white* or *fibrous matter*, wherever it occurs in the body, and also in the fibres of the *great sympathetic*. In the ganglia we find the other form of nervous substance, known by the name of the *gray* or *vesicular*. Wherever these two kinds are united together they constitute a *ganglion* or *nervous centre*.

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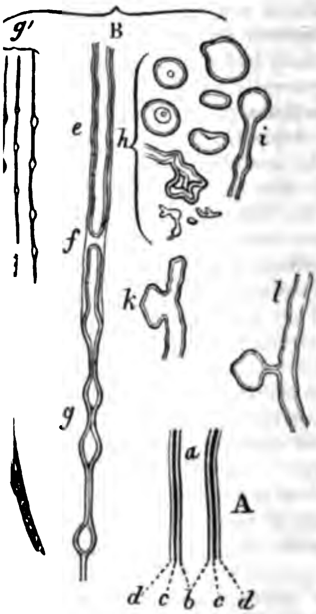
* 4. A muscular fibre of organic life with two of its nuclei (from the bladder). 5. The same from the stomach.

ultimate nerve-fibre—such as is seen in the spinal nerves—nctly tubular. It consists of an external thin and delicate ane, which is nearly or quite homogeneous. It forms one te sheath, isolating the contained matter in its whole course s central to its peripheral extremity. This is called by Todd wman the *tubular membrane*.

ain the tubular membrane lies a more opaque substance, as the *white substance of Schwann*, and within this again is a transparent material, which has been called the *axis cylinder*. The whole of the contained substance is exceedingly soft, and may be made to pass from one part of the tube to another. A bundle of nerve-fibres, surrounded and connected by areolar tissue, constitutes a nerve.

The other form of fibrous matter is that which is seen in the great sympathetic system, and which is known as the *gelatinous nervous fibre*. These fibres contain nothing analogous to the white substance of Schwann, and are devoid of the whiteness which characterizes the tubular fibre. The gray colour of certain nerves depends upon the presence of a large proportion of gelatinous fibres. Hence, they are sometimes called *gray fibres*. They are smaller neter than the tubular fibres, ranging from $\frac{1}{6000}$ to $\frac{1}{4000}$ of ı. (Fig. 12.)

Fig. 12.*



remaining element of the nervous structure is what is called ıy or *vesicular*. This is found in the *nervous centres*, but n the nerves, properly so called. It consists of *cells* or *vesi*-ıtaining *nuclei* and *nucleoli*. The walls of each vesicle are ely thin and delicate, and contain a soft but tenacious gra-

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ıgram of tubular fibre of a spinal nerve:—*a*. Axis cylinder. A. stance. *c. c.* Outer border of white substance. *d. d.* Tubular es; *e*, in a natural state, showing the parts as in A. *f.* The der interrupted by pressure, while the tubular membran ›sities. *g'*. Varicose fibres of various sizes, from the ce n the solar plexus, treated with acetic acid to exhibit thei nular mass. In some vesicles we find a number of pigment granules exterior to the nucleus, giving a dark colour to a portion of the vesicle. The gray colour is not essential; it is merely produced by the peculiar character of the pigment cells. In some animals they are red, in others green, and in others white. In the latter there is no pigment.

Another form of nerve vesicle, is that called the *caudate*, which is characterized by one or more *tail-like* processes extending from it. They contain nuclei and nucleoli, and pigment granules. These caudate processes either serve to connect other vesicles, or else they become continuous with the axis cylinder of the tubular fibres.

The *fibrous* matter is produced, as the muscular fibre, by the coalescence of cells, in which a secondary deposit takes place. The *vesicular* by a succession of cells like those of epithelium.

The chemical constitution of nervous matter is as follows:

| | | |
|---|---|---|
| Albumen, | | 7·00 |
| Cerebral fat, | Stearine, 4·53<br>Elaine, 0·70 | 5·23 |
| Phosphorus, | | 1·50 |
| Osmazome, | | 1·12 |
| Acids, salts, sulphur, | | 5·15 |
| Water, | | 80·00 |
| | | 100·00 |

(*Vauquelin.*)

The amount of phosphorus varies at different times of life, and is exceedingly small in idiotcy. According to L'Heritier's analysis, the *minimum* is found in infancy, old age, and idiotcy; and the maximum of water in infancy.

The *nervous structure*, like the muscular, is constantly undergoing the process of disintegration and renewal, every exercise of this system being accompanied by a loss of its substance, requiring new material to compensate for it. This renewal takes place in the intervals of rest. As in the muscular system, its waste is represented by the amount of urea in the urine, so in the nervous system, is its waste represented by the amount of phosphatic depositions; the latter being always increased under mental exercise. Persons, therefore, whose mental faculties are much employed, require as nutritious a diet as those who gain their "living" by the sweat of their brows.

In regard to the regeneration of nervous structure when it has been destroyed, it is now believed, on the authority of Schwann, Steinruch, and Nasse, that the *white* or *tubular* matter may be restored, they having discovered, that in the uniting substance between the ends of a divided nerve, true nerve-fibres may be developed. Perfect restoration, however, does not always take place,

most probably to the fact, that the central and peripheral
of the same fibres do not always meet again.
gard to the *gray* or *vesicular* matter we are not so well in-
When a portion of the brain is removed in animals, its
supplied by new matter; but whether this becomes true
substance remains to be proved; from the great activity of
itive processes, however, there seems reason to believe that
is repaired by similar matter.
e nerve-fibres which originate in the brain, and are distri-
o the muscles, have no proper *termination;* they form *loops*,
ither return into themselves, or join others formed by the
e ramifications of the main trunks. They never anastomose
ch other, but each runs a separate and distinct course.
ibres which originate on the periphery and run towards the
nd spinal cord, also form loops in these centres.
rever the *vesicular* matter is found, it is looked upon as a
or or *originator* of nervous influence; whilst the *white* or *tu-*
s the *carrier* of that influence to the various parts of the sys-
The former, having the higher set of functions, receives by
larger quantity of blood.
*uses* are formed by the free interchange of fibres from several
uring nerves. Four or five nerves, for instance, proceed
e spinal cord and are plaited up together like the strands of
whip. From the plexus thus formed, certain nerves emerge
are composed of fibres from several of the original trunks.
vantage of this arrangement is, that not only are nerves of
t endowments joined together, but the injurious effects which
therwise result from lesion of the spinal cord, are obviated;
nerves which come off below the injured part, all receiving
s from those which are above, the nervous influence is thus
tted unimpaired to all those parts supplied by filaments from
he point of lesion.

## OF THE DEVELOPMENT OF TISSUES FROM CELLS.

s been seen that there is reason to doubt whether cells are
ed in the development of *all* the tissues, further than in the
ich they take in elaborating the fluid from which the tissues
ived, some of the structures seeming to be produced by a
ation of the plastic fluid which has been elaborated by their
Many of the component structures, however, owe their
ment to the agency of cells, and of these we shall now

are formed in two ways, either in a previously
eless fluid called a *blastema*, or within the inte
existing cells. In the first method, when
ct with a living structure it is seen to bec

this change in colour is owing to the deposition within it of a number of small granules called *nucleoli*; several of these aggregate themselves together and form what is called the *nucleus*, within the interior of which the *nucleolus* can still be seen. This nucleus is also called the *cytoblast* (from κυτος, a vesicle, and βλαϛος, a germ), or *cell-germ*. From the side of this nucleus a thin transparent membrane is next seen to project in the manner of a watch-crystal from the dial; this gradually enlarges till at last the nucleus is seen only as a spot on its wall. The whole is then called a *nucleated cell*, or *germinal cell*. The fluid in which the granules are first deposited is called the *cytoblastema*. (Fig. 13.)

In the *second* method, or the *endogenous* development as it is called, the *nucleus* seems to perform an important office. Each granule of which it has been shown to consist, has the power of developing a cell, so that the parent cell becomes filled with one or more generations of new cells, which may either disappear entirely, as in the case of the ovum, or by the rupture of the original cells the contents may be scattered and undergo an independent development. (Fig. 14.) Sometimes several nucleoli are seen within one nucleus; and sometimes several nuclei within one cell. In some cells the nucleus is wanting, in others, the cell-wall, and in others, again, the contents are absent; so that it is hard to say in which element vitality exists. (Fig. 14.)

Fig. 13.*

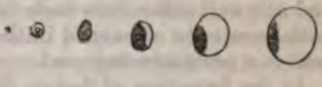
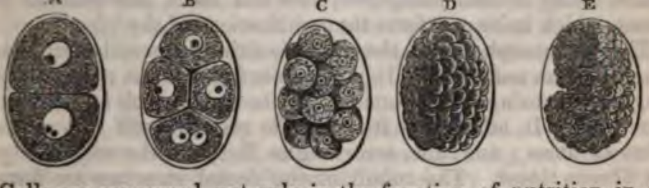


Fig. 14.†



Cells are concerned not only in the function of nutrition in the development and restoration of parts, but also in several other organic processes. In nucleated cells, also, are the best examples of inherent formative power, which, not being consumed in the formation of the cells, remains operative in them, changing them and their contents, and influencing the surrounding or intercellular substance in which they are deposited. Thus, whether it be for the

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* Plan representing the formation of a nucleus, and of a cell on the nucleus, according to Schleiden's view.

† Endogenous development of cells—A, B, C (from Kölliker), ovum of Ascaris nigrovenosa; D and E, that of Ascaris acuminata (from Bagge).

tion of materials from food which may serve to the mainte-
f the body, or for the construction of the several tissues, or
formation or temporary storing-up of the materials that are
moved from the body as refuse, in all these, and in nearly
ances of them, the end is attained by or with the help of the
on, continued energy, or dissolution of nucleated cells.
cell is an independent organ; it lives *for itself* and *by* itself,
dependent upon nothing but a due supply of nutriment and
appropriate stimuli for the continuance of its growth and for
e performance of its functions, until its term of life is ex-
ust as one man is able to support himself alone; but as the cells
commingled into organisms, a division of labour, or separa-
functions, becomes necessary, just as in a community of men
ust be hewers of wood and drawers of water. The nucleus
l-wall differ from each other in chemical composition, though
em to be concerned in the development of tissues. The cell-
a proteine-compound.
e formation of tissues, the cells undergo changes which may
ribed under two heads: *first,* Those affecting the cell-mem-
and *secondly,* Those in which the nucleus is concerned. In
rous tissues, the cell-membranes become elongated, and so
and divided as to give the appearance of subdivision into
threads or fibres. In the compound tubular tissues, as
and nerve, the cells are joined end to end, and the partitions
extremity being removed, a tube is formed, in which the
deposit of muscular or nervous matter takes place.
e simple tubular tissues, as in the capillaries, the tubes are
rmed by the coalescence of the walls of the cells at several
owing to their elongation, here and there, into pointed pro-
which unite and form the ramifications of the vessels.
metamorphoses of the nucleus, although equally important,
ch less numerous. In some cases it sends out radiating pro-
ons causing it to assume a stellate form, which is the case in
lls. In other cases it appears to resolve itself into a fasci-
f fibres; and this, according to Henlé, is the origin of yel-
ous tissue. The tubuli of the dental structure are formed
eparation into a number of distinct fibres, each composed of
aggregation of granules. Lastly, according to Dr. Carpen-
may disperse itself still more completely into its component
s, by whose reunion, certain peculiar vibrating filaments
-called spermatozoa), may be formed, possessing motor
and destined to perform most important offices in the func-
reproduction.
development of cells goes on during the life of the
y period of its existence. They are found fl
numbers in the blood, chyle, and lymph; and
ecretions, as pus. In the inflammatory process

veloped in great quantities; and even the malignant growths, such as cancer and fungus hæmatodes which infest the body, owe their development to the same agencies. In short, the nucleated cell is the agent of most of the organic processes, both in the plant and animal, from the time of their earliest development, to their full maturation and decline.

## PHYSICAL AND VITAL PROPERTIES OF THE TISSUES.

The tissues present manifest differences among themselves, not only in their anatomical structure but in their properties. These properties may be divided into *physical* and *vital*. The *physical* are those which are dependent solely on the peculiar arrangement or mode of cohesion of the constituent particles of the tissues as well as upon their chemical constitution, and are found as distinctly in the dead as in the living texture. The *vital* properties are those which exist only during the life of the *organism*, and which cease whenever molecular life departs.

The most striking of the physical properties, are *Elasticity*, *Flexibility*, *Extensibility*, and *Porosity*.

*Elasticity* is that property by which a tissue reacts, after a stretching or compressing force has been withdrawn. It is strongly marked in the yellow ligament constituting the *ligamentum subflavum*, which is as elastic as India rubber. It is also seen in the middle coat of the arteries, and in the cartilage of the ribs, and on the articular faces of the bones.

*Extensibility* is implied in elasticity; but there are some tissues which are extensible, but not elastic; such yield only to a long-continued distending force; of this we have an example in the resistance offered by a fibrous membrane to the growth of a tumour.

*Flexibility* is seen in the white fibrous tissues, which are flexible, without being either extensible or elastic. We have examples of this property in *the tendons*.

*Porosity*. The property of permeability by fluid, is possessed by the tissues even after death, and is termed porosity or imbibition. Animal tissues owe their softness to the watery fluids which they contain, and which fill their pores.

If a solution of any salt, or of sugar, is poured into a glass tube closed below by a piece of bladder, the particles of the solution permeate the pores of the bladder, but do not pass through it. If the tube thus filled is placed in a vessel containing distilled water, the fluid gradually rises within the tube, and sometimes to the extent of several inches, while at the same time, it is found that a portion of the solution has passed from the interior of the tube to the water external to it.

Dutrochet has named the phenomena above described *Endosmose* and *Exosmose*. The term endosmose, or *imbibition*, being applied

current from *without* to *within*, while exosmose, or *transuda-*
gnifies the passage of the fluid from *within* to *without*.
rder that these phenomena may present themselves, the fluids
e of *different densities*, and miscible with each other; and
these circumstances the current is most rapid, as a general
om the *rarer* to the *denser* fluid, and it continues until the
re of equal density on both sides.
re must also be an *affinity* between the membrane and the
therwise no current will take place.
not membranes only which are endowed with this property;
in plates of slate, or of baked clay, produce the same effect,
in a more feeble degree. Calcareous and siliceous laminæ
o effect of this kind. In membranes, endosmose is produced
y begin to putrefy, when the phenomenon entirely ceases, and
uid which has risen in the tube descends, and filters through
mbrane.
ll the *organic substances* soluble in water, *albumen* produces
ose with the greatest force. It has also been proved by
het, that, all other things being equal, the force which pro-
ndosmose is proportional to the excess of the density of the
liquid over that of the water. Various theories have been
ed to account for these phenomena. Dutrochet's hypothesis,
ectric action is concerned with these phenomena, has not been
ed. The theory of Poisson, that endosmose depended on
ry attraction, is, according to Matteucci, inadmissible. "Pois-
posed that the least dense liquid entered the capillary tubes
membrane, and that this capillary thread, drawn down by
re water, and up by the denser liquid, must be elevated in
of molecular attraction. But this explanation is inadmissi-
en we consider that alcohol, which is lighter than water, pro-
ndosmose; and that certain calcareous and siliceous stones,
under the same conditions as membranes and plates of clay,
give rise to the same effects."* According to the same
up to the present time there is no satisfactory theory of
ose, though many physiologists accept that of *capillary at-*
.
periment proves that the current of endosmose is not pro-
by the least dense liquid, nor by the most viscid one, nor by
ich is endowed with the greatest force of ascent in capillary
The current is in general determined by the liquid which
greatest affinity for the interposed substance, and by which
bibed with the greatest rapidity. In fact
mbrane imbibes the two liquids unequally; and
is imbibed with the greatest facility, ought to mu
t the volume of the other."†

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[*] Matteucci's Lectures, p. 39.

Op. cit. p. 39.

Poisseuille found by experiment, that there was endosmose through animal tissues, from the serum of the blood to Seidlitz water, and to solutions of sulphate of soda and common salt. This is precisely what happens when these substances are used internally as medicines: the rejected excrements contain large quantities of albumen. In this case, it must be admitted that endosmose takes place through the capillary vessels of the intestine, from the serum of the blood to the saline solution introduced into the intestinal canal. The experiments of Poisseuille have been confirmed by Bachetti, who also proved that the rapidity of endosmose is considerably increased, when one of the fluids is in motion and constantly renewed, as is the case with the blood circulating through the capillaries. The most remarkable fact discovered by Poisseuille, is that of the influence exercised by the muriate of morphia. When this substance is added to saline solutions, it very considerably weakens the endosmose from the serum to the solution, and ultimately changes the direction of the current. This has also been confirmed by Bachetti, and upon this is based an hypothesis as to the modus operandi of morphia and of the preparations of opium in diarrhœa, as well as of the constipation they produce.

The animal membranes exercise the property of *porosity* or imbibition in reference to *gases* as well as fluids; and the tendency of dissimilar gases to become diffused among each other, manifests itself even through compound textures. As was shown to be the case with liquids, there is a double current, when two dissimilar gases are separated by a porous septum, and the predominant current is that which has the greatest attraction for the septum. In respiration, this phenomenon occurs at every inspiration through the walls of the pulmonary air-cells and the plexus of capillaries distributed upon them.

It was said that all gases were not equally transmissible. The experiments of Professor Mitchell have demonstrated this fact: and the following list shows their comparative transmissibility, beginning with the most powerful: *Ammonia*, *sulphuretted hydrogen*, *cyanogen*, *carbonic acid*, *nitrous oxide*, *arsenuretted hydrogen*, *olefiant gas*, *hydrogen*, *oxygen*, *carbonic acid*, and *nitrogen*.

The experiments of Brunner and Valentin have led to the interesting result, that when two gases are placed on opposite sides of an animal membrane, the relative proportions absorbed and exhaled, will be inversely as the square roots of their specific gravities. Thus if we have oxygen on one side, and carbonic acid on the other side of an animal membrane, the volume of oxygen that passes inwards will exceed that of the carbonic acid that passes outwards, in the proportion of 1174 to 1000. The application of this to respiration is easy.

Endosmose does not explain all the phenomena of absorption, but

that of those fluids which require no change or elaboration;
laboration is demanded, a vital action becomes necessary.

e properties are entirely dependent on the nutrition of their
ve tissues; they quickly vary with the state of that function,
en it ceases in death, they vanish with it.

L PROPERTIES OF THE TISSUES.—Some of the actions ob-
n living bodies indicate the operation of other properties and
esides those which can be referred to the chemical and mechani-
stitution of organized substances. These properties being the
of phenomena which are peculiar to living beings are named
*operties*, the forces issuing from them, vital forces; the acts
h they are expressed, are vital acts or vital processes; and
e in which these processes are displayed is life.

most general, perhaps a universal property of living bodies,
which is manifested in the ability to form themselves out of
ls dissimilar from them; as when, for example, the ovule
es itself from the nutriment of the fluids of the parent; or
plant, or any part of one, grows by appropriating the ele-
of water, carbonic acid, and ammonia; or when an animal
s on vegetables, and its blood and various organs are formed
e materials of its food. The force which is manifested in
cts is termed *formative* or *organic force* (assimilative or
force); and the processes effected by it are named *assimila-*
*tritive, or formative processes.*

power of self-formation from dissimilar materials, which ap-
o be wholly peculiar to living bodies, and without which,
y, none exists, manifests itself in three modes, which, though
ar different names, yet, probably, are only three expressions
force operating in different conditions: they are *development*,
and *assimilation* or *maintenance*.

lopment is the process by which each tissue or organ of a
ody is first formed; or by which one, being already incom-
formed, is so changed in shape and composition as to be
r a function of a higher kind; or finally, is advanced to
e in which it exists in the most perfect condition of the

th, which commonly concurs with development and con-
fter it, is, properly, mere increase of a part by the inser-
superaddition of materials similar to those of which it
consists. In growth, properly so called, no change of
r composition occurs: parts only increase in weight, and,
, in size; and if they require more power, it is only more
f the same kind as that which they before enjoyed.

similation, or self-maintenance, living bodies preserve t
n notwithstanding the changes to which they are liable thr

the influence of external forces and their own natural decay; and the stability of composition which they thus display is effected by the continual formation of new particles in the place of those that are impaired and removed.

*Contractility* may be reckoned a second vital property. It consists in the power which certain tissues have, during life, of contracting or shortening themselves in a peculiar manner. Such contractility is usually and best observed in fibrous tissues, as in muscles and some kinds of fibro-cellular tissue; but it may be seen, also, in cells and collections of them, as in the muscles of embryoes, while they yet consist of cells, and before any fibres are developed in them.

That which most characterizes the contractility of animal tissues is, that the contraction may be excited by the application of a stimulus to the nerves that ramify in them; and, indeed, it is generally through the nerves that the stimulus which produces a contraction is conveyed. In the section on the MUSCLES it was shown that the property of contractility is inherent in the tissues that contract, and is essentially independent of their nerves, so that contraction *may* take place without the co-operation of the nerves. Therefore, the whole property of *irritability*, including both the capacity of receiving a direct stimulus and the power of contracting in consequence thereof, may be ascribed to the muscles and other contractile tissues. But, in the ordinary conditions of life, the nerves may be said to be necessary to contractions, because, in these conditions it is only through the medium of nerves that a stimulus is applied to the contractile tissues, and when the nerves are destroyed contractions do not naturally ensue.

The *power of conducting* or *transmitting* stimuli or impressions constitutes another peculiar vital property. It may be said to consist in this,—that the state or change which is produced in certain tissues, as in nerve and the fibres of some plants (as the sensitive plant), by the application of a stimulus of any kind, may be propagated through the whole length of the fibre, so that every part thereof shall, with immeasurable rapidity, be brought into the same state as the part first stimulated. Thus the stimulus, or rather the change or *impression* produced by it, is said to be *conducted* in the same way as it is said electricity is conducted along a wire, although at the instant of contact with the source of electricity the whole wire becomes at once electric.*

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* For a fuller exposition of this subject, see Kirke and Paget's Handbook of Physiology, Chap. III., and Carpenter's General and Comparative Physiology, Chap. III., third edition.

# SPECIAL PHYSIOLOGY.

## ERAL CONSIDERATION AND CLASSIFICATION OF THE FUNCTIONS.

very living structure of a complex nature, we see a great of actions resulting from the exercise of the different proper- its several component parts. A general survey of these, ference to their mutual relations to each other, will show ey may be associated into groups, each consisting of a set ns, which, though different in themselves, concur in effecting ositive and determined purpose. These groups and actions med *functions.* A function may be defined *the action of an or system of organs.* Thus respiration is a function; its is the conversion of venous into arterial blood, and its instru- he lungs.

urther examination of these functions, we find that they are ible of some degree of classification. There is a set which d to be possessed by *all* living organized beings, vegetable as animal; these are called the *Organic* or *Vegetative.* These again subdivided into those concerned in the maintenance structure of the individual, or the *Nutritive,* and those to the preservation of the species is due, or the *Reproductive.* is then a set which is possessed by animals alone, in addition e belonging to vegetables, these are called the *Animal func- the functions of relation,* and are dependent for their exer- on the existence of a nervous system, *the presence of which n an organized being marks the distinction between an animal vegetable.* The *Animal functions* render the individual con- f external impressions, and capable of executing spontaneous ents.

e two sets of functions, the *Organic* and *Animal,* are mutually ent on each other, the organic supplying the material neces- r the repair of the instruments of the animal; whilst the functions, in which are included Sensation and Voluntary , are essential to enable the individual to obtain that mate- ich the plant, from the different provision made for it, n obtain without any such assistance. In the animal b functions are so completely bound up together, that none ended without the cessation of the rest.

### TABLE OF FUNCTIONS.

| | ORGANIC. | ANIMAL, OR OF RELATION. |
|---|---|---|
| Nutritive. | 1. Digestion. | 1. Sensation. |
| | 2. Absorption. | 2. Muscular motion. |
| | 3. Respiration. | 3. Mental manifestation. |
| | 4. Circulation. | |
| | 5. Nutrition. | |
| | 6. Secretion. | |
| | 7. Calorification. | |
| Reproductive. | 8. Generation. | |

Three of these have been called the *vital* functions, viz., Innervation, Circulation, and Respiration; these constitute the vital tripod, the maintenance of which, is essential to life.

## ORGANIC FUNCTIONS.

### DIGESTION.

The first of the organic functions may be defined as that by which the *food or aliment is "reduced to such a condition that the nutritive material can be separated from it."* In animals, the food being for the most part in a solid form, requires to be brought to a fluid state before it can be inservient to nutrition, hence the necessity for a digestive process.

In the animal body, aliment is demanded for four different purposes. *First,* for the original construction or building up of the organism. *Second,* to supply the loss occasioned by the continual decay, even when in repose. *Third,* to compensate for the waste occasioned by the active exercise of the nervous and muscular systems. *Fourth,* to supply the materials for the heat-producing process, by which the temperature of the body is kept up.

The amount required for these several purposes, varies according to the condition of the body as regards exercise or repose, external heat and cold, and the age of the individual, a larger quantity being demanded in youth in proportion to the size of the body, than in manhood. Any drain upon the system also increases the demand.

There can be no universal law laid down as to the amount required, so much depending upon the external conditions in which the individual may be placed. The diet scale in the British navy allows to each man from 31 to 35½ ounces of dry nutritious matter daily; of this 26 oz. are vegetable, and the rest animal, 9 oz. of salt meat, or 4½ of fresh meat, being the allowance of the latter. A mixed diet seems to be absolutely indispensable, where such a variety of tissues have to be repaired. The disastrous effects resulting from the long-continued use of one kind of food, are to be at-

d not so much to the quality or quantity, as to the absence
ety in the aliment supplied.

nents have been variously classified; Prout divides them into
lowing groups. *Aqueous*, including water, either alone, or
g important elements in suspension or solution. *Saccharine*,
ng sugars, starch, gums, and vinegar. *Oily* or *oleaginous*,
ng the various fats, oil, and alcohol. *Albuminous*, including
se substances which contain nitrogen—such as fibrine, gela-
lbumen, caseine, and vegetable gluten. All the materials
make up this group are derived generally from the animal
m, with the exception of the last, which is contained in great
nce in wheat. Similar, if not identical, principles exist in
oles.

nilk we find a natural combination of all the various sub-
which contain nitrogen, and this is the only instance in
nature has provided a single article of food for the support of
mal body in which such a union exists.

ig divides aliments into two classes. *Azotised*, and *non-azo-*
The azotised products are for the nutrition and reparation
animal tissues, hence he calls them "*plastic elements of nutri-*
The non-azotised substances are designed chiefly, according
, to supply the materials for animal heat and respiration,
he calls them "*elements of respiration.*" The unconsumed
l being deposited as fat.

R. D. Thomson proposes to call the azotised, *nutritive ele-*
and the non-nitrogenised, *calorifacient*.

organic compounds enumerated would be of little service
t the admixture of certain inorganic substances, which also
part of the animal frame, and which are constantly being
by the excretions. These are *chloride of sodium*, which
into the composition of the gastric juice, and the bile; *phos-*
, which is found in the osseous and nervous tissues; *sulphur*,
in the albuminous tissues; *lime*, which is required for the
dation of bone; and lastly, *iron*, which will hereafter be
to be an essential constitutent of hæmatosine.

digestive apparatus varies greatly with the habits of the ani-
nd with the nature of the aliment with which it is supplied;
*carnivorous* animals it is exceedingly simple, because the
quires to undergo little change before it is fitted for nutri-
In the *ruminantia* the food is macerated in a complex sto-
prior to, as well as after it has been subjected to a more com-
nastication than is employed in other animals, be
t contains but little nutritive matter, which is w
ed from it. In the *omnivorous* animal the di
midway between those above described.

ifications also occur in the masticatory process; the feeder requiring a more complicated dental apparatus; the carnivora being provided with teeth of a simpler construction, but more fitted for seizing and tearing their prey. In the omnivorous animal we find both the cutting and grinding teeth. In birds there are no teeth; and mastication, properly so called, is effected in the stomach, a portion of which (the gizzard) acquires a great increase of muscular power, and is lined by a dense cuticle, and thus becomes a powerful organ for triturating the food, the bird swallowing pieces of flint or other hard substances to aid in the mechanical reduction.

HUNGER AND THIRST.—The want of solid aliment is indicated by the sensation of *hunger;* and that of liquid by *thirst.* The former of these sensations is referred to the stomach, and the latter to the fauces; but, although these sensations may be caused by the condition of the parts mentioned, they are really indicative of the wants of the system at large.

The nerve which is instrumental in the sensation is probably the *vagus* by its gastric branches, but there is no reason for denying to the sympathetic nerve distributed to the stomach, some share in this phenomenon; the latter probably conveys the wants of the system to the stomach, while the former is the medium by which those wants are expressed. Section of the vagus abates, if it does not entirely arrest the sensation of hunger. The same is true of the introduction of matters not alimentary into the cavity of the organ.

*Thirst* results from a peculiar state of the mucous membrane of the digestive tube, but more especially of the mucous membrane of the mouth and fauces, caused by the imperfect supply of liquid. Thirst is perhaps more immediately connected with the wants of the general system than hunger, since the relief that is afforded by the introduction of liquid into the stomach is immediate, and may be fully accounted for by the instantaneous absorption of the fluid into the veins. Any excess in the amount of fluid excretions will increase this sensation, as is also the case when stimulating or irritating articles of food have been used; the purpose of this increase is obviously to cause ingestion of fluid, by which they may be diluted.

The process of digestion may be divided into the following stages: 1st. *Prehension of food;* 2d. *Mastication and insalivation;* 3d. *Deglutition;* 4th. *Chymification;* 5th. *Action of small intestine;* 6th. *Defecation.*

*Prehension*, or the taking of food into the mouth, is performed mainly by the hand, assisted by the lips and cheeks, as well as the anterior teeth and the tongue.

*Mastication* has for its object the comminution of the food, so that it can be readily acted upon by the solvent juices of the stomach.

ntact of the solid food with the interior of the mouth excites
of mastication, performed by alternating contractions of the
s which pull the lower jaw upward, downward, backward,
l, and laterally by acting on the bone in which they are im-
l. By the motion of the lower teeth upon the upper the food
minuted. During mastication the food is mixed with the
nd fluids of the mouth, which latter cavity is closed ante-
nd posteriorly during the process.
disintegration of the food by mechanical reduction, is mani-
ided by *insalivation*. The admixture of the saliva, however,
ncipally a mechanical effect, the nature of the secretion being
t and answering different purposes. That of the parotid
omaxillary glands is thin and limpid, and assists mastication;
the sublingual is thick and glutinous, and assists degluti-
Their effects upon the elements of food cannot be judged of
r reaction out of the body, since it has been shown by M.
d, that in order to convert starch into sugar the saliva must
ndergone incipient decomposition, and must be alkaline, con-
which cannot obtain when the food is rapidly passed into
mach. The saliva, therefore, has probably no other effect
at of softening the food; from the admixture of its watery
s. It is hardly necessary to say that the drier the food,
ater will be the amount secreted.
*utition*.—The food, comminuted and moistened in the mouth
means above mentioned, is prepared for the action of deglu-
In this there are *three* stages. In the *first*, the particles of
d, collected to a bolus, glide between the surface of the
and the palatine arch, till they have passed the anterior
the fauces. This is a purely voluntary movement. In the
the bolus is carried past the constrictors of the pharynx.
*third*, it reaches the stomach through the œsophagus. These
cts follow each other with extreme rapidity.
ng the *second* stage of deglutition, the tongue, the muscles
anterior and posterior half arches, the superior muscles of
t palate, and the constrictors of the pharynx, are all in ac-
In this stage, by the retraction of the tongue, and the eleva-
the larynx, the epiglottis is pressed over the rima glottidis,
s also closed during this process.
communication between the fauces and posterior nares is cut
the muscles of the posterior palatine arches, which contract
a manner, as to cause the sides of the arch to approach each
ke a pair of curtains, and to the cleft between the
la is applied like a valve. Some of these acts m
voluntarily, but the combination of the whole is
der the presidency of the *reflex system* of *nerves*.
e *third* act, in which the food passes through the œs

every part of that tube, as it receives the bolus and is dilated by it, is stimulated to contract.

The movements of the œsophagus are entirely involuntary and rhythmical in their character; in the act of vomiting they are inverted. At the point where the œsophagus enters the stomach,—the cardiac orifice of the latter,—there is a sort of sphincter. This opens when there is sufficient pressure made upon it by the accumulated food, and afterwards closes so as to retain the food in the stomach. The opening of the cardiac orifice is one of the first acts in vomiting. When the sphincter is paralysed by division of the pneumogastric nerve, the food regurgitates into the œsophagus.

*Chymification.*—As soon as the bolus has entered the stomach it is subjected to several agencies, all of which are more or less concerned in effecting its solution. It is exposed in the first place, to the movements of the stomach, which have for their object to produce the thorough intermixture of the gastric juice with the alimentary mass. The fibres of the muscular coat of the stomach are so arranged, as to shorten its diameter in every direction; by the alternate contraction and relaxation of these bands, a great variety of motion is induced. This contraction is due to the stimulus of the food; and when the aliment is difficult of digestion, the muscular coat is proportionately stimulated. These movements are also increased by the action of the respiratory muscles. The contraction of the muscular fibres extends also to those of the two orifices of the stomach so as to prevent the escape of the food. This is particularly the case as regards the pyloric orifice in the first period of digestion.

The bolus, in the next place, is exposed to the action of the *gastric juice*, a pure, colourless, and slightly viscid fluid having a distinctly acid reaction, which has been observed to distil from the surface of the mucous membrane and mingle with the food. The exudation of this fluid is *always* excited by the contact of any foreign substance, but it is never present in the organ when empty, the sole contents being then a little viscid mucus. According to the analysis of Professor Dunglison, the gastric juice contains free muriatic and acetic acids, phosphates and muriates of potassa, soda, magnesia, and lime. According to the experiments of Blondlot, its acid reaction is due to the presence of the super-phosphate of lime, while Professor Thomson and MM. Bernard and Barreswil attribute it to the presence of lactic acid, the existence of which in the healthy stomach has been positively denied by Liebig.

The gastric juice is secreted through cell agency, by follicles of a tubular shape, resting upon the sub-mucous tissue, having their open ends towards the cavity of the stomach.

But diluted acids, of themselves, have no power in chymifying alimentary substances, although their presence in the gastric fluid ıtial to its action. The active agent is an organic compound :d from the mucous membrane of the stomach, to which the ıf *pepsine* or, *gasterase* has been given. It is a proteine-com- in a state of change, and it seems to act in precisely the same r as the diastase does in the conversion of starch into sugar. oing, it acts as a sort of *ferment*, having the power of exciting in another substance, in which it does not itself participate. e undergoes no change itself, and forms no combinations ıe substances on which it acts, but merely disposes them to n in the acids of the stomach, with which they form definite al compounds.

quantity of gastric juice prepared, is regulated by the *wants ystem*, and not by the amount of food taken; hence all that ı over and above these wants will act as a source of irritation. ıubstances are not equally soluble in the juices of the sto- in general terms it may be said, that animal food is more than vegetable, though there are exceptions to this rule *saccharine group*, sugar is generally converted into *lactic* ıring its passage along the intestinal tube, and is probably :d in this form, unless it have been administered for a long The particles of starch, when their envelopes have been rup- ıre converted into *dextrine* and *grape sugar;* which change, r, takes place most largely in the intestinal canal under the :e of its secretion. It is now certain that the substances of .ss may be converted into oleaginous compounds, though the nd situation in which this change occurs is not certainly ; probably it is by the action of the bile, the long-continued of which with saccharine matter occasions the conversion of it into an adipose compound.

ıubstances of the *oleaginous* class do not undergo much change ıtomach, except a minute subdivision of their particles in the ' an emulsion. When the pancreatic secretion is mixed with ıey form an emulsion which is more readily absorbed by the :ous vessels.

*proteinaceous* compounds, whether derived from animal or ıle food, are all reduced to a state of solution, if the gastric ın have been properly performed; and in this state they have properties of albumen. Gelatine will be dissolved, or not, ng to its condition; if ingested in a state of solution it remains previously prepared for solution by boiling, its solution is ted; but if it exist in a tissue from which it cannot be rea- tracted, it will pass out almost unchanged.

*ly*, the bolus is exposed to the *temperature* of the ı is about 100° Fahr. It was found by the experiment ont that the gastric juice had very little effect in ı :ary matters, when the temperature was below this the taking of cold drinks during digestion is extremely prejudicial to this act.

The fluids taken into the stomach are for the most part absorbed from it, and do not even pass the pylorus. The solids, with the exception of the insoluble parts, are reduced to a substance called *chyme*, the consistence of which will of course vary with the amount of fluids taken. In general it is grayish, semifluid, and homogeneous, with a slightly acid taste and smell. When the food has been of a rich character it resembles cream; when of a farinaceous order it resembles thin gruel.

The time occupied in the reduction varies, according to the nature of the food, from three to five hours; and it is now generally conceded that this reduction is a true *chemical solution*, and not a process of *putrefaction*, *trituration*, or *fermentation*.

The *gas* contained in the stomach during digestion is generally very small in quantity. Magendie and Chevreul obtained some from the stomach of an executed criminal, and found it to consist of Oxygen, 11·03, Carbonic acid, 14·00, Hydrogen, 3·55, Nitrogen, 71·45.

*Action of the Small Intestine.*—The passage of the chyme through the pyloric orifice is at first slow; but when the digestive process is nearly completed, it is transmitted in larger quantities. The movements by which this passage is effected are of a peristaltic character, each one being preceded by a series of slighter movements in the opposite direction. The chyme is mingled in the duodenum with the biliary and pancreatic secretions, which effect an immediate alteration in its sensible and chemical properties. "Mr. Bemard has shown, that when this fluid is put in contact with fatty substances of every nature, as oils, animal fats, butter, &c., they are quickly digested or decomposed, and reduced to a state in which they may be absorbed into the circulation. This property is peculiar to the pancreatic juice, not being possessed by the saliva, gastric juice, bile, serum, nor by any other fluid of the animal economy.

"The first effect produced when the pancreatic fluid is put in contact with oil, or any fatty substance, is to form an intimate emulsion, which will not separate on standing.

"If oil is agitated with saliva, gastric juice, serum or pure bile, or any other animal fluid, the mixture separates when in repose. (Bile of animals, mixes, or makes an emulsion with grease, by virtue of the pancreatic fluid, that is frequently mixed with it). After the emulsion is produced, the oil is decomposed into *glycerine* and a *fatty acid*, as the oleic acid, &c., which are absorbable as well as the simple emulsion.

"M. Bernard has also established another very important fact, in regard to the digestive fluids,—which is, that the union of the bile and atic fluid produces a new and distinct fluid, having in addition peculiar properties of these fluids, another superadded, viz.: digesting azotized substances, or in other words the proper- the gastric juice, thus securing the proper digestion of the at may have escaped the stomach.

e property that the pancreatic juice possesses, of transforming into sugar, and which until now has been considered its chief y, is a very subordinate one and by no means peculiar, as all the other fluids of the economy possess it, viz., the serum of the blood, liquor of cysts, &c.” When the bile ncreatic secretions are mixed with chyme out of the body, as ne by Dr. Beaumont, the chyme is separated into three —a reddish-brown sediment,—a whey-coloured fluid in the —and a creamy pellicle on the top. The central portion, e creamy pellicle, seem to constitute the materials from the chyle is elaborated, the creamy matter consisting of the ous particles, and the whey-like fluid containing proteine-com- , saccharine, and saline matters in solution; while the sedi- onsisting of the insoluble matter of the food and of biliary , is probably excrementitious.

contents of the alimentary canal become more consistent, tain more of the fæcal character, as they pass down the intes- be; during which time there is also mixed with them the ns of the various follicles: of Brunner, in the duodenum; uhn, in the whole route; and Peyer, at the termination of m. The last have no excretory orifice, but discharge their n by cell agency. In the neighbourhood of these glands al matter obtains its characteristic odour, probably from their n, which is depuratory.

movements of the intestinal canal are dependent upon the tion of its muscular coat, and are directly excited by the , either of the fæcal matter, or of the secretions poured into is movement is called the *peristaltic action* of the bowels. t dependent on nervous influence, as is seen from the fact, will continue after all nervous communication has been cut he influence of the emotions upon this movement is probably the sympathetic nerve, which is distributed to the whole al tract.

*cation.*—The large intestines act as a reservoir and excretory r the fæces. And as the passage through them is not so s in the small intestine, the fæcal matter accumulates until ire to expel it arises. The contractions of the muscular coat large intestines are wholly without the domain of th involuntary escape of the fæces is prevented by the phincter ani muscle, which is partly under the inf ex system of nerves. The concurrence of the muscles with the action of the intestines, is necessary to overcome the contraction of the sphincter. The act is finally accomplished, principally by a contraction of the diaphragm and abdominal muscles upon a full and sustained inspiration, the glottis being closed so as to prevent the escape of the air contained in the lungs.

## ABSORPTION.

**Absorption** is that function, by which nutritive, or other matters, are taken up and carried into the circulation. There are two great divisions of this function: 1st. *External absorption*, or *the absorption* of *composition*, which obtains from without the organs the materials intended for their construction. 2d. *Internal absorption*, or, the *absorption* of *decomposition*, which takes up from the organs the old, or effete matter that has to be replaced by new.

By *external absorption* is meant that which takes place from the external surface of the body, including the skin, and the mucous membranes of the digestive and respiratory passages. By *internal*, or *interstitial absorption*, is meant that which takes place from the component tissues of the organs themselves, and from the interior of shut sacs.

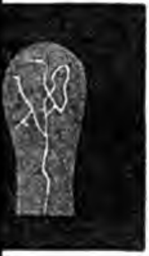
The great agents of external absorption are the veins and chyliferous vessels; of internal absorption, the lymphatics. In the chyliferous and lymphatic vessels the fluid is always found to possess the same general properties.

The veins exert no selecting power, but receive into their interior by imbibition, any fluid that possesses the proper degree of tenuity, which is then carried along with the current of the circulation. Thin fluids when taken into the stomach, in this manner enter the circulation. When the extraordinary vascularity of the whole gastro-intestinal membrane is considered, together with the peculiarity of the special distribution of the capillaries in the villi; and when it is remembered also that the rapid movement of blood through these, creates the condition most especially favourable to the passage of liquids into them from the outside, it might be almost certainly affirmed that endosmose must take place between the contents of the alimentary canal and the blood in the vessels. This conclusion has been confirmed by numerous experiments, so that we can now understand that solutions of albumen, gelatine, or sugar, may pass into the blood-vessels by endosmose, when the relative densities of the two fluids on the two sides of the intestinal membrane are such as to favour the inward current. So also if the exterior liquid be such as to favour exosmose, some of the constituents of the blood may be drawn into the intestinal canal, as is seen in the case of purgative salts, already referred to (page 49). Matters which find their way from the stomach or intestines into the circulation, by permeating the coats of the capillaries, do not

irectly from the intestinal veins into the vena cava; they cir-
through the liver before reaching the general circulation.
ndie has observed, that in their transit through the liver the
rties of many substances are altered; at all events they become
roughly mixed with the blood in their route through the por-
stem, that their possibly injurious influence upon the centre
circulation is in a great measure, obviated. Substances that
e digestion, on the other hand, must pass through the chyli-
vessels and thoracic duct before being mixed with the blood.

*mentary, or digestive absorption,* which is included under the
of *external* absorption, takes place in the small intestines, and
rcised upon the food after it has been subjected to the digestive
ss. The vessels that are concerned in it are the *lacteals,* or
ents of the intestinal walls. These are engaged almost exclu-
in the absorption of *nutritious materials;* other articles find-
eir way into the circulation through the veins. The lacteals
ence in the *villi* of the mucous lining of the intestinal tube,
the point where the ductus communis choledochus and pan-
c duct open into the duodenum. Each lacteal tube commences
single villus, by a *closed extremity,* and the trunk that issues
each villus is formed by the confluence of several smaller
hes, which anastomose freely with each other, forming *loops,*
so that there is no proper free extremity in any case, nor do the lacteals *ever commence by open orifices upon the surface of the intestinal canal.* (Fig. 15.)

Fig. 15.



The *lacteals* appear to receive substances of a particular class, more especially fatty matters in a state of more or less fine division, with which albuminous compounds are intimately mixed. These, whether received at once into the lacteals by the instrumentality of cells at the extremity of the villi, or first imbibed by the blood-vessels and then transferred to the latter, are doubtless obtained directly from the
as the chyle varies somewhat with the quality of the food
being an opaque white if the food were fatty, and more
arent if that article were absent. On the whole it seems pro-
from the experiments of Bernard, Matteucci, and others, that
nction of the lacteals is to take up the oily particles of food,
bring them into that intimate relation with albumen which
to be essential for their subsequent assimilation. Still, there
son for the belief that the blood-vessels also may be concerned
absorption of oily matters by endosmose, since Matteucci has
that oily emulsions will pass by endosmose through an animal
rane, to an alkaline solution on the other side, precisely the

condition of things that occurs when fatty matters have been reduced to a state of fine division in the alimentary canal and rendered alkaline by admixture with the bile and pancreatic fluid; they can then pass through the animal membrane to mingle with the blood, which is also slightly alkaline.

The fluid that is found in the lacteals is called *chyle*, and the chyliferous vessels seem to have the power of *selecting* the particles of which the chyle is composed, while they reject any other ingredients which may be contained in the fluid of the intestines, as is seen when substances easily detected, are mingled with the blood: they are readily discovered in the blood or urine, but not in the chyle.

The milky colour of the chyle is owing to the presence of minute particles described as the *molecular base of the chyle.* It also contains fat, albumen, fibrine, and salts in varying quantities.

The course of the chyle, after leaving the intestinal canal, is through the chyliferous vessels and ganglia of the mesentery, into the receptaculum chyli or commencement of the thoracic duct, along which it passes to enter the circulation at the point where the left internal jugular and subclavian veins unite. During this passage it undergoes several marked changes in its physical and vital properties. When it first leaves the intestine its principal constituent is *fat;* if examined in the lacteal vessels of the mesentery, at a point between the mesenteric ganglia and the receptaculum chyli, the fat will be found to have diminished in quantity, while *albumen* will be in maximum quantity and *fibrine* in medium quantity; and a slight coagulability will also be manifested. The chyle taken from the thoracic duct contains little or no fat, a medium quantity of albumen, and a maximum quantity of fibrine, and is now distinctly coagulable, and has a slight rosy tint. These circumstances have given rise to the belief that the chyle, as it proceeds, becomes more and more animalised, or transformed into the nature of the being to be nourished. MM. Tiedemann and Gmelin infer that it is to the action of the mesenteric glands, that the chyle owes these important changes in its nature;—the fluid in its passage through them, obtaining from the blood circulating in them, the new elements which animalise it.

The *chyle corpuscles* are supposed by Dr. Carpenter to originate in the mesenteric ganglia, and to be the altered epithelium-cells which line the lacteals in their course through these bodies. Their function is, according to this author, to convert the albumen into fibrine, since they are found to be most abundant where this process is going on.

*Internal*, or *interstitial absorption*, is effected by agents strongly resembling those concerned in the absorption of chyle. One part of the apparatus, the thoracic duct, is common to both. The lymphatics are distributed through the greater part of the body, especially upon the skin. They have never been found to commence by closed or open extremities; but seem to form a network from which the trunks

In their course they pass through glands called lymphatic
which exactly resemble in structure and function those of
sentery. The same processes are probably concerned in the
tion of the *lymph*, as of the *chyle*, and the fluid thus formed
wise a nutritive fluid, differing from the chyle, however,
in the absence of fat. It is mingled with the chyle in the tho-
uct. So that what is true of *chylosis*, is also true of *lym-*
both forming a part of the nutritive operations.

lymphatics, however, sometimes take up materials that are
ervient to nutrition, as bile, pus, the venereal and other virus
ay be brought in contact with them. But these facts merely
hat the walls of the lymphatics are permeable by such sub-
, for thin fluids will always enter those vessels that present
nnest walls and the greatest surface. As this is the case with
nphatics upon the surface of the body, it explains the phe-
ι of absorption through that surface. In the lungs and in the
ial canal, the veins are most numerous, hence these are the
its of the thin fluids. In both cases the fluids soak in by imbi-
In the case of the absorption of pus, the probability is that
orbents must have been laid open themselves by the ulcerative
, since the pus-globule is too large to have gained admittance
other way.

difficult to speak with certainty of the *source* of the matters
ed by the lymphatics. Their contents bear a close resemblance
fluid element of the blood, or "liquor sanguinis" in a state of
ι. Dr. Carpenter supposes them to consist of the residual
vhich having escaped from the blood-vessels into the tissues
ir nutrition, is now to be returned to the former. They may
elude those particles of the solid framework which have lost
ital powers, and are therefore not fit to be retained as compo-
f the living system, but are not yet so far decayed as to pre-
ieir serving as materials for reconstruction after being again
ed to the organizing process.

same author says further, that if this view of the function of
nphatics be correct, it follows that we must attribute to the
essels the absorption of truly effete particles; and in this
vould seem to be no improbability, since we know that the
blood contains the elements of two important excretions, that
liver and that of the lungs, in far greater proportion than
blood; and there is also in the former fluid a certain amount
-defined animal principles" that seem ready to be thus thrown

lymph very closely resembles the chyle, the mai
n their colour, the lymph being nearly colourless.
e same ingredients, but not in the same proport
ing most in organic elements. Both contain p

cles, and are capable of self-coagulation; in fact, each may be looked upon as imperfectly-elaborated blood.

The movements of the chyle and lymph in their respective vessels are due partly to *vis à tergo,* but mainly to the contractility of the middle coat. Both sets of vessels are supplied with valves, which prevent a retrograde movement.

The absorption that takes place through the skin, or *accidental absorption,* as it is called, is effected by the agency of the lymphatics also, which are here very abundantly distributed. In this case there is no selection, the fluids passing in by simple imbibition. In the pulmonary mucous membrane, as in the digestive, thin fluids are taken up by the veins. In general, wherever a thin fluid is placed in contact with an extended surface, it will be taken up by those vessels that present the largest surface and the thinnest walls. The rapidity of this absorption through the skin and mucous membrane, is greatly influenced by the condition of the blood-vessels; being very great when the vessels are drained of their contents, and proportionately small when they are full. The presence or absence of the epidermis affects it, as might be readily inferred. The external integument, so long as it covered with the epidermis, absorbs with extreme slowness; the epidermis removed, however,—by means of a blister,—and the vascular lamina of the corium exposed, absorption goes on with extreme rapidity. It is upon this fact that what is called the *endermic* method of exhibiting medicines depends.

In regard to the absorption of fluids from serous cavities, it is remarked, that imbibition does not explain all the phenomena; the probability is that the lymphatics under certain circumstances are also concerned. If the fluid in the veins be more concentrated than those to be absorbed, then imbibition is sufficient. But if, on the contrary, the external fluid is equally concentrated with that contained in the interior of the vessels, the two fluids ought to pass through the membrane in both directions with equal rapidity. And if the fluid in the vessels be less concentrated of the two, it will exude in greater quantity, so as to increase the amount of the effused fluid. A collection of fluids in the pleura or peritoneum, containing albumen and salts in the same state of concentration as these substances exist in the blood, would not be diminished in quantity by imbibition alone; there would be merely an interchange of the saline matters contained in the external fluid and in the blood, while the bulk of the former would remain the same. The probability is, therefore, that in this case there would be other agents than the blood-vessels concerned in the absorption, viz.: the lymphatics. It is possible that the process of endosmosis may be modified by a peculiar attraction exerted by the tissues on the fluids circulating in them; an attraction, by the agency of which the fluids in the tissues

e retained while the external fluid is absorbed, so that merely
tion, and not an interchange of fluids, as is the case under or-
circumstances, is the result.

## RESPIRATION.

PIRATION is that function by which venous blood is converted
terial; carbonic acid, given off from, and oxygen taken into
stem. In the higher classes of animals the whole of the cir-
g fluid is sent through special organs, formed on the same
l principle as the secreting glands, which fulfil incessantly an
he most essential to life; these organs are the lungs. In the
the mass of the circulating fluid, which had been changed in
riphery of the body into venous blood, mixed with the lymph
ll parts, and the newly-elaborated chyle, is brought into in-
contact with the air of the atmosphere, the effect of which is
ore to the blood its bright colour, and to give to it the ar-
character, which is alone competent to minister to nutrition,
impart to the nervous system and locomotive apparatus their
stimulus. The arterial blood, thus changed, also supplies
secretory apparatus the material for the exercise of its func-
All that is necessary then for these purposes is, that the
should be exposed to the influence of the atmospheric air, or
solved in water, through the medium of a membrane that
ermit the diffusion of gases; an interchange then takes place
n the gaseous matters on the two sides,—carbonic acid being
d from the blood and replaced by oxygen.
extrication of carbonic acid is effected in a manner that renders
servient to the introduction of oxygen, which is required for
most active manifestations of vital power; and it is in these
tions conjointly, not in either alone, that the function of re-
on essentially consists. It will be remembered that the car-
cid passes out through the animal membrane by exosmose,
e oxygen passes in by endosmose.
sources of the carbonic acid given off in respiration are three-
st. The continual decay of the tissues: which is common to
anized bodies; which is diminished by cold and dampness, and
ed by warmth and moisture; which takes place with increased
y at the approach of death, whether this affects the body at
or only an individual part; and which goes on unchecked
he actions of nutrition have ceased altogether.
The metamorphosis which is peculiar to the nervous and
lar tissues; which is the very condition of their ac
therefore bears a direct relation to the degree in w
rted.
The direct conversion of the carbon of the food int

acid; which is peculiar to warm-blooded animals, and which seems to vary in quantity in accordance with the amount of heat to be generated.*

The organs of respiration are always formed upon the same general plan, being essentially membranous prolongations of the external surface, adapted by their permeability and vascularity to bring the blood into close relation with the surrounding medium.

As this medium may be either air or water, we find two principal forms of respiratory organs, one of which is adapted for each. In aquatic animals the membrane is usually prolonged externally into tufts or fringes, each one of which is supplied with arteries and veins, during the circulation through which the aeration is accomplished. These organs are called *gills*.

In air-breathing animals the aerating surface is reflected inwardly, forming passages or chambers into which the air is received, and on which the capillary vessels are distributed.

In insects we find a series of tubes called *tracheæ*, ramifying through the body and carrying air to every part of it. In these tubes there is a spiral deposit, (as is also seen in the sap-vessels of plants) upon their inner surface, the object of which is to keep the calibre of the tube always open.

In regard to the human lung, according to the observations of Mr. Rainey, a bronchus, when traced from its commencement to its termination, is seen in the first part of its course to be more or less cartilaginous; it then becomes destitute of cartilage, retaining, however, a perfectly circular form, and having no air-cells opening into it; farther on, being still circular, numerous air-cells open into it; lastly, the air-cells increase so much in number, and open into the bronchus so closely to one another, that the tube can no longer retain its circular form, but becomes reduced to an irregular passage running between the cells, and, ultimately reaching the surface of the lobule, ends by forming a terminal air-cell.

The air-cells are small irregularly-shaped cavities, having usually four or five unequal sides; those which are situated close to the small bronchial passages open into them by well-defined circular apertures, while those at a distance from these passages open one into the other, as in the lung of the frog and serpent; in fact, each lobule of the lung of the mammal and man, with its bronchial passages and appended cells, may be regarded as a repetition of the whole lung of the frog.

The sides or walls of the air-cells are formed of a thin transparent membrane, and the capillary vessels are so placed between the walls of two adjacent cells as to be exposed on their two sides to the action

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* For a more detailed account of these sources of carbonic acid, of which the above is merely a recapitulation, see Carpenter's Elements of Human Physiology, 2d American edition, p. 371 and seq.

r. The number of capillary plexuses is not the same as that ir-cells, one network passing between and supplying several in other words, one terminal branch of the pulmonary artery the plexuses of several cells.

s been calculated by M. Rochoux that as many as 17,990 are clustered around each terminal bronchus, and that their mber amounts to 600 millions.

etal lungs, according to Mr. Rainey, prior to respiration, are y seen, when injected, to possess air-cells fully formed, and led, as in the animal which has respired, by plexuses of blood-

hemical process of respiration is not essentially dependent espiratory movements. They merely serve to expel the air, r) which has undergone the change induced by the chemical constantly carried on between it and the blood, and to renew ly of fresh air or water.

ungs, by their internal surface, offer an immense expansion ction of the blood and air on each other; and as they are mpletely emptied by the act of expiration, this action is con- By the contraction and dilatation of the chest, the motions of e lungs follow, a portion of the altered contents of the pul- reservoir is first expelled, and then a new supply introduced, go change in its turn.

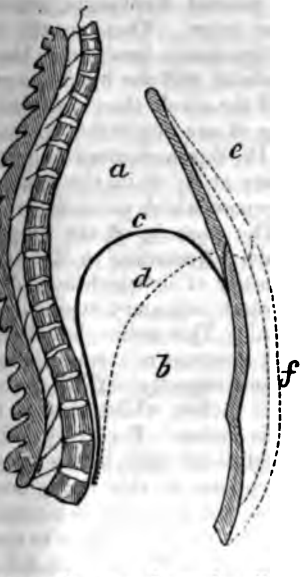
ding to the inquiries of M. Bourgery, the development of the continues up to the age of thirty, at which time the capacity ration is greatest; it subsequently decreases, especially in who suffer from cough. The violence of such expiratory requently causing rupture of the air-cells, thus gradually g that emphysematous condition of the lungs so common in people. The power of increasing the volume of air by a spiration is much greater in young than in old persons, and as great in males as in females of the same age, a circum- hich is evidently connected with the extent to which muscular an be carried in these classes respectively.

*nents of Respiration.*—These may be divided into two those of *inspiration* and those of *expiration*. By the first the action by which air enters the lungs; by the latter, the xpelling from the lungs the air received in inspiration.

mmalia generally, as well as in man, inspiration and expi- re performed by the dilatation and contraction of the cavity horax. As soon as the walls of the chest are drawn wide , and the thorax dilated, the external air rushes through the and its branches into the air-cells, distending them in to the dilatation of the thorax, thus keeping the accurately in contact with the thoracic walls in nts. This contact, however, can only take place thoracic cavity is closed on all sides, so that the air cannot exert any pressure on the *outer* surface of the lung, by which that upon the inner would be balanced. Hence it is, that in penetrating wounds of the chest, the lungs cannot be fully distended by inspiration, because the air entering through the wound into the cavity of the pleura balances the pressure of the air on the inner surface; the lungs, in such a case, remain collapsed, although the thoracic parietes dilate.

*Inspiration.*—The diaphragm contributes the principal share to the dilatation of the chest during inspiration. In its relaxed state this muscle is arched; by contracting it becomes more plane; and by this flattening of its arch, the capacity of the thorax is increased, at the same time that the abdominal viscera are pressed upon from above, so as to produce the protrusion of the abdomen observed during inspiration. (Fig. 16.)

Fig. 16.*



In a natural, tranquil inspiration, the dilatation of the chest is effected almost entirely by the diaphragm. The lateral dilatation, as in deep inspiration, is performed principally by the action of the intercostal muscles, assisted also by the scaleni, the levatores costarum, the serratus posticus inferior, and the thoracic muscles generally. In the old, inspiration is mainly accomplished by the diaphragm, in consequence of the ossification of the cartilages of the ribs.

The number of inspiratory movements varies greatly under different circumstances. In general it may be stated from 14 to 18 usually occur in a minute; of these the ordinary inspiration involves but little movement of the thorax; but a greater exertion is made at about every fifth recurrence.

The average numerical proportion of the respiratory movements to the pulsations of the heart, is about 1 to 5 or 4½, and when this proportion is widely departed from, there is reason to suspect some disorder of the respiratory apparatus or the nervous system.

*Expiration*, when perfectly tranquil, may be the result of the

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* Section of thorax and abdomen. *a.* Thorax. *b.* Abdomen. *c.* Relaxed diaphragm. *d.* Contracted diaphragm.

llapse or elastic reaction of the parts, recovering their natu-
te, after the active dilatation they have undergone; in fact,
l respiration seems to consist more in the periodic action of
scles of inspiration, than in the alternate action of antago-
muscles. Among the elastic components of the respiratory
may be mentioned the cartilages of the ribs, the cartilages of
nchial tubes, and the capsule of elastic tissue described by M.
which invests the lungs, and sends prolongations inwards, and
sticity of the air-cells themselves. The muscles which are
ed in expiration are the abdominal, which draw down the
d by compressing the abdomen force the viscera up against
xed diaphragm, and thus diminish the cavity of the thorax
low. These are the recti, obliqui, and transversi abdominis,
dratus lumborum, the serratus posticus inferior, the sacro-
is, and the longissimus dorsi.

e whole time occupied by a respiratory act, from the begin-
one inspiration to the beginning of the next, be represented
the inspiratory movement may be estimated at 5; the expi-
at 4; while the remaining 1 will be occupied by the period
se which succeeds expiration.

*capacity* of the lungs varies very much in different indivi-
According to Mr. Hutchinson, by this term is meant "that
y of air which an individual can force out of his chest by the
t voluntary expiration, after the greatest voluntary inspira-
This author has shown that in health, this capacity bears a
nstant relation to the height of the individual. Thus the
capacity" of 172 males under the height of 5 ft. 8 in. is 220
ches, whilst that of 82 males from 5 ft. 11, to 6 ft. is 255
ches. For every additional inch of height (from 5 to 6 ft.),
ional cubic inches are given out by a forced expiration. The
ons to this occur among stout and corpulent individuals,
capacity stands lowest. The size of the chest, therefore, is
ays a criterion as to the capacity of expiration. Mr. Hutchin-
o found that the full expiratory force of a healthy man is
nly one-third greater than his inspiratory force. The quan-
t habitually and almost uniformly is changed in breathing, is
by Mr. Hutchinson *breathing air*. The quantity over and
his which a man can draw into the lungs in the deepest in-
n, he names *complemental air*: its amount is various, as has
own. After ordinary expiration, such as that which expels
*athing air*, a certain quantity of air remains in the lungs,
nay be expelled by a more forcible and deeper expiration:
terms *reserve air*. But, even after the most violent e
ort, the lungs are not completely emptied; a certain qu
remains in them, over which there is no volun
ich may be called *residual air*. Its amount

great measure on the absolute size of the chest, and has been variously estimated at from forty to two hundred and sixty cubic inches.

According to the experiments of Mr. Coathupe, about 266⅓ cubic feet, or 460,224 cubic inches of air, pass through the lungs of a middle-sized man in 24 hours; reckoning the average number of inspirations at 16 per minute, this would give 20 to 25 cubic inches as the amount inhaled at each.

*Residuary air.*—Upon the residuary air, depends the lightness of the lungs, which enables them to float upon water; in fact, when once these organs have been distended by a full inspiration, no mechanical, or other power, can dislodge the air so as to cause them to sink in water. Upon this circumstance was based the hydrostatic test of infanticide. The residuary air also gives rise to the tympanic resonance on percussion.

In the act of inspiration the air within the lungs is alternately increased and diminished in amount; and thus a regular exchange is secured. This exchange, however, affects only a portion of the contained air at a time, and this proportion appears to vary according to the frequency of the respiration. Indeed, if it were not for the tendency of gases to mutual diffusion, the air in the remote cells might never be changed. Probably about one-eighth of the whole contents is changed at each inspiration. As long as the residuary air contains any oxygen, aeration of the blood will take place, provided always the heart continues to act; but as soon as the contained oxygen is consumed, asphyxia begins to occur, unless a fresh supply is obtained. The residuary air will probably support life about three minutes.

*Influence of the nerves on respiration.*—The source of the nervous influence on which the different respiratory movements depend, is one and the same, although the nerves implicated in these movements are very various. The *Medulla Oblongata* is the source from which the nervous influence for the respiratory motions is derived, and the spinal cord is, as it were, the trunk of the nerves which arise from it. If the spinal cord is divided above the point where the dorsal nerves are given off, the motions of the ribs and abdominal muscles are paralysed, while the other respiratory movements continue. If it is cut above the origin of the phrenic nerve, then the diaphragm is paralysed, while the nerves given off from the medulla oblongata itself still continue to exert their function. Injury of the *medulla oblongata* arrests instantly all the respiratory movements, both those dependent on the par vagum, and those on the spinal nerves.

The respiratory movements are partly voluntary, partly involuntary. Partly voluntary, in order that they may be inservient to the production of vocal sounds, and to the actions of speech, sing-

. Partly involuntary, lest in sleep, or in moments of for-
ess, the movements of respiration should be suspended, and
sults ensue.

combined action of the respiratory muscles is under the in-
of that portion of the nervous system called the *reflex;* a
hich does not involve the will, or even sensation, and which
ntinue to transmit its influence when all the other parts of
rvous centres have been removed. The principal excitor, or
*t* nerves, are the *par vagum,* and the sensory branches of
h pair, the former conveying impressions from the lungs, the
from the general surface. If the par vagum be divided on
des, the movements of respiration are greatly diminished in
ncy.

*mical phenomena.*—The prominent phenomena in respiration
e removal of a certain quantity of oxygen from the air, and
lacement by carbonic acid; and the change in colour of the
from a dark venous hue, to a bright scarlet or arterial. The
e proportions of oxygen inhaled and of carbonic acid exhaled,
each other inversely as the square roots of their specific gra-
that is, the quantity of oxygen absorbed will exceed that of
ic acid given off in the proportion of 1174 to 1000. Car-
acid contains precisely its own volume of oxygen; conse-
y, of the 1174 parts of oxygen absorbed, 1000 are again ex-
as carbonic acid, leaving 174 parts, or nearly 15 per cent. to
ounted for. Some of this unites with the sulphur and phos-
of the original components of the body; the remainder most
ly enters into combination with the hydrogen of the fatty
, thus forming part of the water exhaled by the lungs.

the nitrogen which enters so largely into the composition of
heric air, a small portion only is absorbed, in consequence of
ficulty with which it passes through animal membranes; its
se in the atmosphere being to dilute the oxygen. The exha-
and absorption of nitrogen appear usually to balance each
so that the amount of this gas in the respired air undergoes
r no change.

quantity of carbonic acid exhaled varies at different times,
nder different circumstances. The mean of a great number
ervations gives about 160 grains of carbon per hour as the
ty set free by an adult; this would give 8 oz. Troy in the 24
The amount varies with the development of the body, and
he sex. In males, the quantity increases from eight years of
l thirty; it remains stationary till forty, and then decreases
l age, when it little exceeds that at ten. An extrao
pment of the muscular system is always accompanied
ation of a larger quantity; the reverse is also true.
emales there is the same proportional increase

from which time it remains stationary during the menstrual life; after which it increases. After fifty, it decreases as in men. During pregnancy the amount of exhalation is increased, and the same takes place whenever the menses are temporarily arrested.

The quantity exhaled is also increased by cold, exercise, or a full meal, and by many of the exanthemata. It is diminished in typhus fever, in chronic diseases of the respiratory organs, and in sleep.

Independently of these variations, there is a difference in amount in accordance with the time of day, being least at midnight, gradually increasing till midday, then again declining till midnight.

The sources of the carbonic acid have been already adverted to. It is not formed in the lungs as was originally supposed, but in the tissues themselves, as is shown by the facts that venous blood contains a larger amount of this gas than arterial; and that an animal placed in hydrogen, or nitrogen, still continues to evolve carbonic acid.

In regard to the change of colour effected by respiration, it must be regarded as a purely physico-chemical phenomenon, inasmuch as the same changes will take place in blood exposed to the air out of the body, even through the medium of a thick membrane, such as a bladder. The precise cause of the change of colour is as yet unsettled. By Liebig it is supposed that the iron in the red corpuscles is the real agent in the respiratory process, and that the corpuscles are the carriers of oxygen into the system, and of carbonic acid out of it. He supposes the iron to exist in the form of protoxide in venous blood, united with carbonic acid, forming a carbonate of the protoxide of iron; in the lungs, the carbonic acid is given off, leaving the protoxide, which by union with half an equivalent of oxygen, is converted into the peroxide, at the same time that the colour is changed to arterial. In the systemic capillaries the reverse takes place,—the oxygen being imparted to the tissues, and replaced by the carbonic acid, which is given up by them to be conveyed out of the system.

Mulder, Scherer, and others, account for the change of colour, by a change of *form* in the red corpuscles, which are supposed to be bi-concave, and reflecting bodies in arterial blood, and bi-convex, and refracting bodies in venous blood. Mulder shows that the *colour* is not dependent on the presence of iron, since it is retained when all the iron has been entirely removed.

The presence of a certain amount of saline matters appears, from the experiment of Dr. Stevens, to be essential for the due influence of oxygen upon the colour of the blood; since, if they be deficient, the contact of oxygen will not produce its usual effect.

The blood parts with a considerable amount of water in the lungs, amounting to 16 or 20 ounces in 24 hours. It also absorbs volatile matters from the air. The water contains some animal matters,

s its source, according to Dr. Prout, in the chyle which has
en poured into the blood; probably also it escapes by evapo-
hrough the thin animal membrane.

*yxia.*—If from any cause the supply of oxygen be cut off,
tion ensues to which the name of asphyxia has been given;
ential character of which, is the cessation of muscular move-
and shortly afterwards of the circulation, with an accumula-
blood in the venous system. The time necessary for the
tion of this state is inversely proportionate to the development
respiratory function; thus, warm-blooded animals are much
asphyxiated than reptiles. In the former, deprivation of air
minutes is sufficient to produce insensibility and loss of mus-
ower. The circulation generally fails within ten minutes.
first effect of non-arterialization of the blood in the lungs, is
ardation of the fluid in their capillaries, an accumulation in
ous system, and a deficient supply to the arterial. The ope-
of these two causes arrests the action of the heart, although
ct on the two sides is different; the right side ceases to act
ver-distension; the left, from deficiency of stimulus to excite
vement. If the stoppage have not been too long, the heart's
may be renewed by artificial respiration; for the replacement
gen in the air cells restores the pulmonary circulation, and
t the same time, relieves the distended right ventricle, and
s to the left the due stimulus to its action. In conclusion, it
stated, that the post-mortem appearances are always the
asphyxiated individuals, no matter what may have been the
f death.

## CIRCULATION.

his term is understood that function by which the nutritive
conveyed to every part of the body through appropriate
ls. This distribution is spoken of under the general title of
*rculation of the blood;* the organs and canals by means of
and through which it is accomplished constitute the *vascular*

greater circulation was discovered in the higher animals by
n Harvey in 1619, and although it cannot be asserted to be
versal character of all animals, yet at every advance of obser-
new traces of vessels are discovered in the most simple

re is a circulation in plants as well as in animals, and its ob-
the same. There is no central organ, however; the elaborated
distributed partly by vis à tergo, partly by capillary
e influence of light and air upon the leaves, but mai
nity between the elaborated sap and the tissues of th
he organic cells of plants there is a circulation in tl

rior, upon their inner walls, which has never been satisfactorily explained. It consists in a regular movement of a viscid fluid, without any apparent impelling power. It ascends against gravity, and sometimes communicates its movements to the nucleus. In this movement the chlorophyll granules participate, and the movement in each cell seems to be independent of its neighbours. It probably exists also in the organic cells of animals.

In the higher orders of animals, there are two distinct circulations, with a heart for each. These two circulations are entirely separate and distinct from each other in the perfect adult, as are also the hearts belonging to each, being merely brought together for economy of material and space. They are called the greater and the lesser; or the systemic and pulmonic.

The course of the blood through these two circuits, may be likened to the figure 8; and the heart is placed at the junction of these. Each system has its own set of arteries or efferent trunks, and veins or afferent trunks; these communicate at their central extremity by the heart; and at their peripheral extremity by the capillary vessels, by which are meant the minutest ramifications of the two systems inosculating into a plexus.

The route of the circulation is as follows: the venous blood is collected in the right auricle, thence it passes through the tricuspid orifice into the right ventricle; thence it is distributed to the lungs through the pulmonary artery to be aerated, after which it is collected by the pulmonary veins and carried to the left auricle, from which it passes through the mitral orifice into the left ventricle, and from thence through the aorta to the system.

The chief impelling power of the circulation, is the rhythmic motion of the heart. This organ is endowed in a remarkable degree with the property of *irritability* or *contractility;* by which is meant "the capability of being easily excited to movements of contraction alternating with relaxation." This property is an endowment strictly belonging to the heart, and is not derived from any connexion with the nervous system, since it has been shown to continue after all connexion has been severed. It is retained much longer in the cold-blooded than in the warm-blooded animals; and in the very young animals than in the old.

This movement of the heart cannot be accounted for by the stimulus of the blood, since it will continue when the heart is empty; nor yet by the stimulus of *air*, since it persists even *in vacuo;* and it has been shown above that they are independent of the nervous system; they must therefore depend on the *vis insita*, though the exciting cause cannot be positively determined.

If the heart of a living mammiferous animal or bird is laid bare, the two ventricles are seen to contract together; and the two auricles, with the commencement of the pulmonary veins and of the avæ almost simultaneously; the contraction of the auricles at of the ventricles, however, *not being synchronous.* The tion of all the cavities is followed by their dilatation; the tion is called the *systole;* the dilatation, the *diastole.*

auricles are but little concerned in the propulsion of the they being mere sinuses or receptacles. The *systole* of the le corresponds with the projection of the blood into the arte- using the pulse; whilst the diastole coincides with the col- f these vessels.

n the ventricles contract, the blood is prevented from returno the auricles by the tricuspid valve, on the right side; and by tral valve on the left. But in some circumstances the closure tricuspid valve is not complete, and a certain quantity of s forced back into the auricle; and, since this may be advan- , by preventing the over-filling of the vessels of the lungs, been called the *safety-valve action* of this valve (Hunter, son King). The circumstances in which it usually happens se in which the vessels of the lung are already full enough the right ventricle contracts, as, *e. g.* in certain pulmonary s, in very active exertion, and in great efforts. In these erhaps because the right ventricle cannot contract quickly pletely enough, the tricuspid valve does not completely close, regurgitation of blood may be indicated by a pulsation in gular veins synchronous with that in the carotid arteries. the ventricles dilate, the blood is prevented from re-entering avities, by the semilunar valves at the mouth of the aorta lmonary artery. The dilatation of the ventricles may be uished into two stages: the first immediately succeeds their , and manifests itself in the recession of the heart's apex e walls of the chest; the second stage is attended with the ment of the heart in all directions, and is synchronous with icular contractions. It is between these two stages that the l of repose takes place.

diastole of the heart, according to Cruveilhier, is an active out of its cause no precise account is given. It is supposed wing to the presence of the yellow fibrous tissue, interwoven e muscular substance, upon whose elasticity the first stage entricular diastole is supposed to depend; the second stage aused by the ingress of blood produced by the auricular

*impulse of the heart* must not be confounded with the artelse. The heart's impulse is the shock communicated by its the walls of the thorax in the neighbourhood of the f th ribs.

*ds of the heart.*—When the ear is placed over the pr gion, two sounds are heard, following each other in succession, at each beat of the heart. These sounds are followed by a short interval of repose, after which they recur, again followed by repose, and so on. The sounds are of different lengths; the *first* being the longest. If the whole interval, from the beginning of one pulsation to the beginning of the next, be divided into four equal spaces of time, the first two will be occupied by the first sound, the third by the second sound, while the fourth will represent the period of repose.

The first sound coincides with the systole of the ventricles, the pulse in the arteries, and the impulse against the walls of the chest. The second, with the first stage of the diastole of the ventricles. The first is a dull, prolonged sound, the second is short and sharp, and follows so immediately upon the first that it can hardly be imagined to occur during the systole of the auricles, as has been supposed.

The *causes* of these sounds have given rise to much discussion. The first is evidently complex, having several elements in its composition. The principal cause of it is found at the orifices of the aorta and pulmonary artery, and is produced by the rush of the blood through these comparatively narrow outlets. Another element is found in the passage of the blood over the rough internal surface of the heart; a third element, in the sound of muscular contraction accompanying the systole of the ventricles; and a fourth in the *impulse* of the heart against the walls of the chest; for when the impulse is prevented, the sound is much diminished.

In regard to the *second* sound, which accompanies the first stage of the *diastole* of the ventricles, there is not so much doubt. It is produced by the sudden shutting down of the semilunar valves at the orifices of the aorta and pulmonary artery, the function of which valves is, to prevent the reflux of the blood into the ventricles during their dilatation.

*To sum up*, the causes of the *first sound*, are: 1st. The rush of blood through the narrow orifices of the aorta and pulmonary artery; 2d. The passage of the blood over the rough internal surface of the ventricles; 3d. The sound of muscular contraction; 4th. The impulse against the chest. The cause of the *second sound* is, the sudden shutting down of the semilunar valves at the orifices of the aorta and pulmonary artery.

The following table* will perhaps assist the student in connecting the sounds of the heart with its movements:

| | |
|---|---|
| *First Sound.* | Ventricular systole, and auricular diastole. Impulse against the chest. Pulse in arteries. |
| *Second Sound.* | First stage of ventricular diastole. |
| *Interval.* | Short repose: then auricular systole, and second stage of ventricular diastole. |

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[*] Carpenter's Human Physiology.

*capacities of the different cavities* of the heart are said to
ightly, as well as the *thickness of the walls;* the right auricle
ntricle are said to be most capacious, while the left auricle
ntricle have the advantage in thickness of their walls; the
ntricle having its parietes nearly three times as thick as the
since it has to exercise more force in sending the blood to the
; parts of the system.

ı cavity will hold about two fluidounces, but it is probable
e ventricles do not entirely empty themselves at each stroke;
ill therefore discharge about 1½ ounces at each pulsation.
ıing 75 pulsations in a minute, there will pass through the
n this time, 112 oz., or 7 lbs. of blood. The whole quantity
d in the human body is equal to about ⅕th of its weight, or
in a person weighing 140 lbs. This quantity would there-
ss through the heart once in four minutes, and would circu-
out fifteen or twenty times in an hour.

ent experiments would seem to show that this is below the
te, since substances introduced into the venous circulation
een detected in the remotest parts of the arterial system in
an 30 seconds.

*force* with which the heart propels its blood has been variously
According to Hales, the usual force of a man's heart would
a column of blood 7½ feet high, the weight of which would
ut 4 lbs. 6 oz. According to Poisseuille, who caused the blood
ıpon a column of mercury, the force of the heart is equal to 4
oz. The true estimate of this force is found by multiplying
ssure of blood in the aorta into the surface of a plane passing
ı the base and apex of the left ventricle; according to which
ınd to be about 13 lbs.

*number of contractions* of the heart in a minute, is about 70
The frequency of its action gradually diminishes from the
ncement to the end of life. Just after birth, it ranges from
130; in old age, 65 to 50. Age, sex, muscular exertion,
ns, and temperament, exert a controlling influence over the
action. In persons of sanguine temperament, the heart beats
requently than in those of the phlegmatic, and in the female
re frequently than in the male. Its action is also increased
meal, and by rising from a recumbent, to a sitting or stand-
ture. The time of day also affects it; the pulse is more fre-
in the morning, and becomes gradually slower as the day
es.

nflammations and fevers, the pulse is much more frequent
uring health. When the vital powers decline, it
ıt and feeble. In nervous affections, with more op
xhaustion of the forces, the pulse is often remarkably

### 'EMENT OF THE BLOOD IN THE ARTERIES AND CAP

he action of the left ventricle, the blood is forced and distributed throughout the whole body, with the exception of the lungs, and passes through the capillaries into the veins.

The pressure of the column of blood against the elastic walls of the arteries, at every contraction of the ventricle, produces what is called the *pulse*. The sensible pulse of the arteries is synchronous, or nearly so, with the contraction of the ventricle; it is somewhat later than the heart's beat, especially in the distant vessels, but the difference of time is scarcely perceptible. In the capillaries and veins, the pulse is no longer perceived.

There is found to be a very close correspondence between the areas of the branches and that of the trunk from which they spring. According to a well-known geometrical law, the areas of circles are as the squares of their diameters. Now, if we add together the squares of the diameters of the branches of a given vessel, we will find that their sum is about equal to the square of the diameter of the parent trunk, showing that the conjoint size of the branches is not greater than that of the main trunk, and that the vascular system cannot be compared to a cone whose apex is at the heart, and whose base is at the circumference of the body, with a regularly increasing surface; but rather to a cylinder, whose diameter is equal throughout, and the pressure upon whose walls is at every point the same.

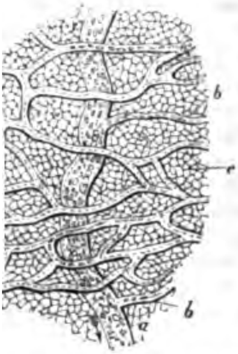
The arteries are possessed of three coats, an external, cellular; a middle, composed of muscular fibres and yellow fibrous tissue; and an internal, which is serous. Upon the *elasticity* of the yellow fibrous tissue is dependent the property by which the interrupted force of the heart is made equable and continuous, and which is seen most in the large vessels connected with that organ. The *contractility* of the muscular fibres, which they have been shown to possess, is concerned in regulating the flow of blood towards particular organs. Their contractility is most plainly seen at a distance from the heart, where the impelling power of this organ becomes almost null. Under these circumstances, the muscular coat becomes an important adjuvant.

The muscular coat has also another function, that of *regulating* the diameters of the tubes in accordance with the quantity of blood to be conducted through them to any part; this is seen in the enlargement of the uterine and mammary arteries, during pregnancy and lactation, and in their return to their normal size after these periods are over. These changes are due to the contractility of the muscular fibres of the middle coat, probably regulated by the sympathetic nerve, which is minutely distributed upon the vessels. In the permanent dilatation of arteries, however, in parts that are undergoing enlargement, their nutrition is also increased, the walls being thickened as well as extended.

In addition to the elasticity and contractility already described, ıent indicates the existence of that power of *slow* contraction ırteries to which the name of *Tonicity* has been given; this, r, does not seem to be anything else than a particular mani- n of the general property of vital contractility, and is quite from ordinary elasticity. The manifestation of this property when a ligature is applied to an artery, the part beyond the becoming gradually smaller, and emptied to a greater or gree of the blood which it contained. The empty condition of ries after death is due to the same cause. It is to the mode- ion of the *Tonicity* of arteries, that these contractions upon am of blood passing through them, is due. If the tonicity ssive, the pulse is hard and wiry; but if it be deficient, the very compressible, though bounding, and the flow of blood the arteries is retarded.

smaller arteries in every organ of the body, before they be- apillary, are connected by repeated anastomoses with each he object of which arrangement is, to supply the circulation part, when an important vessel leading to that part is either compressed or obliterated. The capillary system of all connected parts being continuous, all the vessels, whether arteries or veins, are united through its medium.

Fig. 17.*



CAPILLARIES.–It has been shown that in all organic textures the transmission of the blood from the minute branches of the arteries to the minute veins is effected by a network of microscopic vessels, in the meshes of which the proper substance of the tissues lies. These minute vessels are called *capillaries*, from their small size; and they may be seen by the aid of the microscope in the web of the frog's foot, ail of the tadpole, and the lungs, urinary bladder, or tongue frog. (Fig. 17.)

*size* of the capillaries is proportioned to that of the red par- f the blood, and can be measured in parts finely injected. liameter varies from $\frac{1}{1000}$th to $\frac{1}{4000}$th or $\frac{1}{3000}$th of an inch. filled with blood they are not so much distended as when in- and have seldom been measured when so filled. No other tary tissues are much more minute than the capillarie oscopic observations and minute injections have show the capillary vessels are merely the fine tubes which form the medium of transition from arteries to veins, and that *no other kind of vessels arise from them;* that the minute arteries have no other mode of termination than the communication with the veins by means of capillaries; in a word, *that there are no vessels terminating by open extremities.* (Muller.) *Serous vessels,* that is, branches of the blood-vessels too minute to allow the passage of red particles, and consequently traversed merely by the lymph of the blood, may *possibly* exist, though they have not been demonstrated. What have probably been mistaken for them, are vessels which are so small as to admit only a single row of blood-corpuscles, the amount of colouring matter in which is not sufficient to tinge the light transmitted through them. The existence of vessels in the substance of the cornea, which were supposed to be *serous* or white vessels, is, according to Muller, very doubtful; they have never been injected.

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* Fig. 17, capillaries in the web of the frog's foot, magnified.

The existence of membranous parietes in the capillary system has been doubted by many physiologists, but more accurate research seems to establish the fact that such is the case. The fact that fluids injected into the arteries pass into the veins without extravasation, and that currents cross above and below each other without mixing, have been adduced as arguments for the existence of membranous walls. Besides which, Windischmann has dissolved away the other tissues in a delicate membrane found in the ear of birds, leaving the beautiful vascular network, with the meshes empty. Schwann has also discovered by the microscope, that the capillaries have not merely membranous parietes, but a coat in which circular fibres can be distinguished as in the arteries.

The capillary circulation seems to be in a great degree independent of the heart's action, since it has been seen to continue in cold-blooded animals after complete excision of the heart. The emptiness of the arterial system after death, although partly owing to the *tonicity* of the arteries themselves, is commonly more complete than could be thus accounted for, and must therefore be partly due to the capillary circulation. Farther, the process of secretion, which could not take place unless the capillary circulation were still continued, has also been seen to continue after death. In the embryo, the blood circulates *before* the heart is formed; and instances are not wanting in which the heart was entirely absent during embryonic life, and yet the greater part of the organs were well developed. In the latter case the circulation must be due to capillary power. The local determination that takes place whenever the processes of nutrition and secretion are carried on, and the increased rapidity of the movement without corresponding increase of the heart's action, also go to support the idea of an independent capillary power.

These facts, and others to prove that the circulation in a part

arrested, while the heart is still acting, and the vessels per-
eem to be favourable to the belief in the existence of such
.

gard to the *nature* of the power, it cannot be *mechanical*,
movement of contraction or dilatation has ever been seen.
ditions under which the power in question uniformly ope-
ay be thus expressed:—"Whilst the injection of blood *into*
illary vessels of every part of the system is due to the action
heart, its rate of progress *through* those vessels is greatly
l by the degree of activity in the processes to which it
be normally subservient in them;—the current being ren-
nore rapid by an increase in their activity, and being stag-
y their depression or total cessation."

the capillaries seem to have a *distributive* power over the
egulating the local circulation independently of the heart's
and in obedience to the necessities of each part.*

views of Prof. Draper in relation to the dependence of the
ion of the sap in plants upon chemical changes in the cir-
fluid, assist to explain very satisfactorily the capillary cir-
in animals. A brief and modified summary of these views
given. Experiments on inorganic bodies show, that if two
communicate with each other through a capillary tube, for
ls of which they have an unequal affinity, the liquid which
greater affinity will be absorbed most energetically, and
e other before it. This is what seems to take place in the
d tissues, permeated by nutritious fluid. The particles of
id, and the solid matter through which it is distributed,
certain affinity for each other, which is exercised in the nu-
hanges, to which the fluid becomes subservient during the
of its circulation. Certain matters are drawn from it in one
carry on the nutritive process; in another, to accomplish
ction of secretion. The fluid, which has given up to one
ome of its materials, has no longer the same affinity for that
it is consequently driven from it by the superior attraction
ssessed by the tissue for another portion of the fluid con-
the required ingredients; this in its turn is rejected for a
pply.

he fluid, thus repelled from one part, may still be attracted
another; because that portion of its contents which the
quires may not yet have been abstracted; and thus the flow
blood is maintained through the capillary network until it is
er exhausted of its nutritive matter.

ough the circulation is not *dependent* upon nervous p
ence is nevertheless manifest, as is occasionally seen i

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* Carpenter's Princip. p. 564.

functions of nutrition and secretion, by the control it exerts over the diameter of the blood-vessels. The phenomena of blushing, pallor, and the erection of certain tissues, are also examples of a modified condition of the blood-vessels through the agency of this system.

THE VENOUS SYSTEM arises in the small trunks formed by the union of the capillaries; and it returns the blood to the heart. These vessels are possessed of the same number of coats and the same properties as the arteries, only not so strongly developed. The internal membrane is thrown into valves or folds to prevent the reflux of the blood. The *capacity* of the venous system is said to be considerably greater than the arterial, holding two or three times as much blood as the latter.

The venous circulation is mainly due to *vis à tergo;* it is assisted, however, by *vis à fronte*, in the *suction power* of the heart. The *inspiration of venous blood* is also said to assist it. By this is meant the rush of blood towards the chest, in order to supply the vacuum created there by the descent of the diaphragm. That it has some influence is seen in the partial emptying of the veins in inspiration, and their turgidity in expiration. But that it can have no *general* influence over the venous circulation, will perhaps be seen from the fact that the pulmonary circulation, being entirely within the chest, cannot be affected by atmospheric pressure, and also that the circulation of the fœtus in utero cannot be aided by any such agency.

*Muscular movements* are among the most important adjuvants to the venous circulation, every contraction being accompanied by a pressure upon the veins of the part; and as the blood is prevented by the valves from flowing back into the small vessels, it must be driven on towards the heart. This is familiarly seen in blood-letting, every movement of the hand increasing the flow of blood from the orifice.

A few of the peculiarities of the circulation may be mentioned in conclusion. These are first, in the *pulmonary circulation*, in which *venous* blood is sent from the heart, and through a tube which is *arterial* in its structure; whilst *arterial* blood is delivered *to* the heart through several venous trunks.

The *Portal circulation* is also peculiar in its arrangements, the venous blood ramifying through vessels disposed like arteries, and having to overcome the resistance of an additional capillary system in the liver, before reaching the heart.

The portal circulation is entirely independent of the pulsations of the heart, and differs from all other venous circulations in the fact that there is an intervening organ between the vein and the heart. The blood, instead of passing directly from the portal vein to the heart, is forced to traverse an organ seated upon its course to the

of circulation. The portal, and indeed the circulation in all
lominal viscera, is under the direct influence of the pressure
abdominal walls. This pressure is essential and indispensable
circulation of the blood through the abdominal organs, and
larly so to its passage through the portal system. If a small
g be made in the abdomen of an animal, a portion of intestine
ıdrawn, and a hydrometer be placed in one of the veins and
testine returned into the abdomen, an oscillation will be
ed in the tube at each inspiration. The blood is elevated in
e, because at each inspiration the abdominal cavity is dimi-
by the descent of the diaphragm and the contractions of the
s. A notable pressure is thus applied to the contents of the
which is in some degree measured by the elevation in the
The pressure is increased or diminished in proportion to the
of the inspiration. If, after the introduction of the instru-
he walls be largely opened, the oscillations will cease, because
ssure is obstructed. In this case the elevation will not only
but there will be a counter-current or regurgitation from the
r vena cava and liver into the vena portæ and mesenteric
If prussiate of potash be placed in the inferior cava, by
of a tube, and the abdomen opened, it will regurgitate with
rent of blood into the vena portæ. This regurgitation occurs
ıcentesis abdominis for ascites; the pressure is removed and
the syncope. The portal circulation is then entirely dependent
he abdominal pressure, which last is dependent upon respira-

*Erectile tissues* appear essentially to consist of a plexus of
c veins, enclosed in a fibrous envelope, which plexus, ac-
g to Gerber, is traversed by numerous contractile fibres, to
ıtraction of which is probably to be attributed that obstruction
return of blood by the veins, which is the occasion of their
cence. In the penis, according to Müller, there are two sets
ries, one destined for the nutrition of the organ, the other, by
ınicating with venous cells, for its erection. In all the erectile
, erection may ensue either from local irritation, or as a result
ain emotional conditions of the mind, the influence of which
ably transmitted through the sympathetic nerve.

### NUTRITION.

ording to the definition of Adelon, nutrition is the action by
every part of the body, on the one hand, appropriates or assi-
s to itself a portion of the blood distributed to it, and, on the
ıand, yields to the absorbing vessels a portion of the
reviously composed it. The process of nutrition is n
microscopic observation; the precise mode, therefore,
ccomplished is not accurately known. The *source of*

*tion and of all growth is the blood*, from which the materials are shed or separated, to be employed in the renovation and reparation of the tissues. This is obviously only to be accomplished by the parenchyma selecting from the capillaries and intermediate vessels those ingredients that can become inservient to this process. The structure composing every separate portion of the body has what may be called an *elective affinity* for some particular constituents of the blood; causing it to abstract from that fluid, and to convert into its own substance, certain of its elements. The *selecting power*, possessed by the component cells of every tissue, is exercised not only upon the materials required for their development, but even upon substances abnormally present in the blood: thus arsenic will produce irritation of the mucous membranes of the body; and the continued introduction of lead into the circulating system modifies the nutrition of the extensor muscles of the forearm, producing the phenomena of *lead palsy;* the existence of this modification is proved by chemical analysis, which reveals the existence of lead in the palsied muscles. Substances thus introduced into the blood affect the symmetrical portions of the body; thus the extensor muscles in both arms are paralysed; and the cutaneous eruptions produced by the internal exhibition of certain remedies, are found to be almost precisely symmetrical; the presence of the medicine in the blood being the occasion of a disordered nutrition of certain parts of the skin; and the selecting power of particular spots being evinced by the exact correspondence of the parts affected on the two sides.

In the process of nutrition is exemplified the fundamental principle of organic assimilation. Each elementary particle of an organ attracts similar particles from the blood; and by the changes it produces in them, causes them to participate in the *vital principle* of the organ itself. Nutrition does not consist merely in the component particles of the organs attracting the fibrine, albumen, and other materials of the blood which flow through them, adding to themselves the matters similar to their own proximate principles, and changing the composition of those which are dissimilar; but the assimilating particles must infuse into those newly added to them their own vital properties. Mere increased size is not nutrition; parts may be increased in size by the deposition of fibrine, as in inflammation, but this fibrine is unassimilated, and not endowed with the vital properties of the tissue in which it is deposited, and in this consists the difference between increased nutrition and increased size. It was said that the source of all nutrition was the blood: a short account of this fluid may be necessary here. The *chyle* and the *lymph*, which are also generally considered as nutritive fluids, have been already described under the head of Absorption.

The blood, whilst circulating in the living vessels, consists of two parts,—a thin, transparent, nearly colourless liquid, termed *liquor* *is;* and a number of small bodies, called the *red corpuscles,* ich the colour of the blood of vertebrated animals derives its r hue; in addition to which are found some *white* or *colourless* les.

n the blood has been drawn from the body and allowed to spontaneous coagulation takes place, dividing it into *crassa-* and *serum.* The crassamentum, or clot, is formed by the f the fibrine and red corpuscles, by the entanglement of the n the meshes of the former. Whilst the serum is merely the sanguinis deprived of its fibrine. From the fact that the oagulates by the addition of heat, we know that it contains n; by exposure to a high temperature, the animal matter is osed, and a considerable quantity of earthy and alkaline salts

distribution of these constituents in living and dead blood seen in the following table.

| | | |
|---|---|---|
| g blood. | Fibrine,<br>Albumen,<br>Salts, | In solution, forming Liquor Sanguinis. |
| | Corpuscles. | —Suspended in Liquor Sanguinis. |
| blood. | Fibrine,<br>Corpuscles, | Crassamentum, or clot. |
| | Albumen,<br>Salts. | In solution, forming serum. |

mean proportion of these different ingredients in a thousand f blood may be thus stated: *Fibrine,* 3 parts; *Albumen,* 80 *Red Corpuscles,* 127 parts; *Water and Salts,* 790 parts. proportions are subject to considerable variations within the f health. There is also a small amount of fatty matters and ive. The following is the analysis of Simon made upon the f males: *Water,* 791·9; *Fibrine,* 2·0; *Corpuscles,* 114·3; *en,* 75·6; *Extractive Matters and Salts,* 14·2; *Fatty Mat-* 0. There is a greater amount of solid matter in the blood nale than of the female, except in the case of *albumen,* which rger quantity in the female.

of the prominent constituents of the blood has been already ed in the earlier pages of these divisions, to which the reader red.

n the blood is examined shortly after a meal the serum is o present a milky appearance. According to Drs. Buchanan D. Thompson this appearance is due to the admixture of the The period at which the discoloration is greatest, however, e length of time during which it continues, vary kind and quality of the food, and the state of the ns. The milkiness seems to be entirely due to ginous matter in the food. The crassamentum often exhibits a pellucid fibrinous crust, sometimes interspersed with white dots; and this seems to consist of an imperfectly-assimilated proteine-compound, analogous to that found in the serum. A small quantity of sugar is occasionally found, even in healthy blood, when large quantities of it are taken as food. But commonly it is transformed into lactic acid, or into fatty matter, before it is received into the circulating current.

By some physiologists the coagulation of the blood is looked upon as a mere physical process, dependent upon the exposure of the fluid to the air, precisely as some chemical substances are known to solidify under similar circumstances; and the long delay of the coagulation after death is mentioned as confirmatory. By others it is contended that the coagulation is the last act of vitality of the blood, which is evident from the incipient organization which may be detected even in an ordinary clot; and still more from the fact, that if the effusion of fibrine take place upon a living surface, its coagulation is the first act of its conversion into solid tissues possessing a high degree of vitality. If not within the influence of a living surface, it soon passes into a state of decomposition.

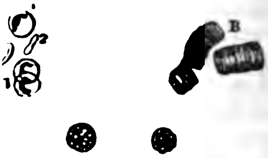
The rapidity of the coagulation depends very much upon the circumstances in which the blood is placed. It is accelerated by moderate heat, and retarded, though not prevented by cold. The blood that flows *last* from a vessel coagulates more rapidly, but less firmly, than that first drawn; and in inflammatory blood, in which the fibrine is increased, coagulation is unusually slow.

In certain disordered conditions of the blood, the surface of the clot is not unfrequently covered with a layer of fibrine nearly free from colour, and known as the *buffy coat.* This is commonly looked upon as positive evidence of the existence of inflammation. Such is not really the case, however, since it is seen in very opposite conditions of the system, as in chlorosis. In inflammation the amount of fibrine is really increased, and the coagulation of the blood is much retarded. This allows the corpuscles time to sink to the bottom, leaving the upper part of the clot composed of fibrine alone, which is nearly destitute of colour and very tenacious in its character, while the lower part obtains its deep red colour from the presence of the red particles. The layer of fibrine in its coagulation undergoes contraction of its edges, thus giving rise to the cupped appearance of inflammatory blood. The buffy coat is also seen in the blood of pregnant females; and also in that of chlorotic patients, in whom the fibrine is *relatively* in excess over the red corpuscles.

In idiopathic fever the amount of fibrine is lessened; should inflammation supervene, however, the fibrine is increased. The increase here is not due to the febrile condition, but to the local inflammation, which, according to Andral, is always accompanied by an increment in the amount of fibrine.

corpuscles of the blood, in coagulating, apply themselves to ther so as to resemble piles of money. It is said that in in- ‚tory blood they are more closely applied, and the areolæ be- the piles are larger than in healthy blood. Fig. 18 represents rangement, and the shape of the corpuscles.

Fig. 18.*



The *materials* of the nutritive process being prepared in the blood, every tissue and every organ attracts from it particles similar to itself, or metamorphoses the proximate principles of the blood into its own elements. The blood is distributed to the tissues by the capillary system of vessels, with a degree of minuteness varying with the y of the nutritive operations taking place in the individual It is in the capillary system that all nutrition takes place, stic material being selected, as before described, by the com- cells of the tissue to be nourished.

mode in which the tissues are developed by cells, has already xplained. It was then shown that in the production of any form of tissue, nature does not at once unite the organic les in that form, but that she first creates in a structureless or in previously-existing cells by a definite process, round s or cells, and subsequently transforms these into the various ts of the organic textures.

process of nutrition varies greatly according to age, consti- idiosyncrasy, state of health, &c. It is most rapid in youth, the growth of the body; it is greatly less in old age; but widely with reference to particular organs. Morbid condi- excessive bodily and mental efforts, the depressing emotions, s care and sorrow, are all incompatible with perfect and pow- nutrition, and induce wasting of the several organs. As a l rule it may be stated, that the greater the demand for the nal activity of the organ or tissue, the more energetic is its on, and *vice versâ*. Whenever the amount of nutritive mate- posited in a tissue or organ is more than sufficient to supply ste, the part becomes *hypertrophied* or *over-nourished*. The ypertrophy signifies *excessive nutrition*. It differs from healthy on only in degree. It consists in the augmentation of one or f the natural constituents of an organ, in such a manner that wly-formed parts are continuous with those alre nnot be anatomically distinguished from them.

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lood-corpuscles, seen on their flat surface and edge. B. Conger lumns.

is never known to affect the *whole* body, to a degree sufficient to constitute disease. But examples of hypertrophy of particular organs or tissues are very common. *Atrophy*, or diminished nutrition, is exactly the reverse of the condition just described, but is more generally a morbid operation, and may affect either the whole body or individual parts. It takes place whenever the waste of the tissues is more rapid than their replacement by nutrition.

The nutritive operations, by which lost parts are repaired, take place with great activity. In its most perfect form, this process is analogous to that of the first development of the corresponding parts, and its results are as complete in the one case as in the other.

The reparative process was formerly thought to depend on the existence of inflammation; it can be shown, however, that in the majority of instances inflammation is injurious rather than beneficial.

"That the powers of reparation and reproduction are in proportion to the indisposition or incapacity for inflammation; that inflammation is so far from being necessary for the reparation of parts, that in proportion as it exists, the latter is impeded, retarded, or prevented; that, when inflammation does not exist, the reparative power is equal to the original tendency to produce and maintain organic form and structure; and that it then becomes a natural function, like the growth of the individual, or the reproduction of the species."*

The continual death, or destruction of the individual cells which enter into the composition of the organs or tissues, constitutes what is called *molecular death*, to distinguish it from *somatic death*, or the death of the *whole body*, which follows upon the cessation of the respiratory and circulatory functions. Molecular death, however, is not always an immediate result of somatic death, since it is known that the lives of individual parts may be prolonged after the suspension of the regular series of their combined operations; so on the other hand, molecular death may take place to a considerable extent if the function of the part have no immediate relation to the indispensable actions just alluded to, without somatic death necessarily resulting.

There is no valid reason for believing that the processes of nutrition are *dependent* upon nervous influence, although, as before stated, it is known that they may be influenced by it. These processes go on with great regularity and rapidity in the vegetable kingdom, in which nothing approaching to a nervous system exists; and in the animal kingdom they take place long before any nervous system begins to be developed; the conversion of the primary cells into muscular tissue, bone, and mucous membrane takes place in virtue of

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* Treatise on Inflammation, p. 7, by Dr. Macartney.

erent properties of the primary tissue itself, since no nervous
ɔe can be supposed to operate before nerves are called into
ce.

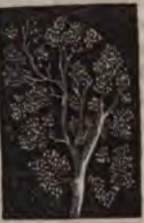
## SECRETION.

ly allied to the function last considered (nutrition) is that of
*n*, which means literally *separation*. In both, certain ma-
are separated from the blood; in nutrition, the object of the
ion is to build up the living body; in secretion, to get rid of
useless substances, or to supply certain other combinations
ay either directly or indirectly be essential to the economy.
essential character of the true secreting process seems to con-
; so much in the nature of the action itself, for this is identi-
h that of nutrition, both being effected by a process of cell-
, but in the position in which the cells are developed, and
nner in which their products are disposed of. In secretion,
duct of the action of the cells is delivered upon a free surface,
nicating, more or less directly, with an external outlet, or
vities provided with orifices that lead to them.
organs by which the latter operations are effected, are called
*g organs*, and the matters separated are spoken of as *secreted*
or simply as *secretions*.
stinction has been made between those secretions that are
ed with an ulterior view as means to other functions in the
y, such as the saliva, gastric juice, &c., and those that are
iately rejected from the organism as useless, as for example,
ie, &c. The first are regarded more peculiarly as *secretions*;
er, as *excretions*.
he reason why one organ should separate bile, another milk,
other sperm, no other account can be given than that which
hem to the special endowments of the *cells*, the real instru-
in the process. That the particular modification of structure
the organ may present, has no essential connexion with the
er of the secretion, is evident, from the fact that almost every
nay be found under a variety of forms in different parts of
mal series; and for every gland there is a part of the animal
elow which it does not exist, and when it makes its first
nce it almost always presents a character nearly as simple,
of the least complex glandular structures in the higher

*simplest form of secreting organ* is that of the simple *animal*
*ne*, well supplied with blood-vessels and covere
; of such a membrane we have an exan
l membranes. The next is that of the
rsion of the animal membrane, lined w

and abundantly supplied with blood-vessels, from which are elaborated their peculiar secretions. The *third* and *last* form of secreting organs is the *gland*, which is nothing but an aggregation of follicles, closely packed together, so as to present a large secreting surface in as small a bulk as possible. In some glands the sacs or follicles are prolonged into cæca or blind tubes, as in the kidney and testis; these are called *tubular glands;* or else they are very greatly multiplied, and clustered together (like currants on a stalk) upon efferent ducts common to several of them. (Fig. 19.)

Fig. 19.



In all secreting organs the important agents are the *cells*, which are developed upon the lining membrane of the follicles and tubes, and which select and elaborate the materials from the blood, and discharge their contents into the excretory duct. These cells are being constantly cast off and replaced by a new growth, having their origin in the basement-membrane of the mucous membrane which lines the ducts or follicles.

The simplest condition of a secreting cell in the animal body is that of the adipose tissue, every cell of which has the power of selecting its materials from the blood. The contents of these, however, are not discharged, but remain stored as a reservoir in time of need. The *adipose tissue* has already been described.

There is a difference between the processes of *secretion* and *exhalation:* the former is a *vital* process, the latter a *physical*. Wherever a fluid requires to be elaborated, it is done by a process of secretion, and the agents are *cells;* but where no such process is necessary, the fluid pre-existing in the blood, it soaks out by the physical process of exosmose.

The *exhalations* do not require much notice after what has been said of their mode of separation. Under this head are included those from *serous* and *synovial membranes*, which are destined to lubricate them; the fluid of the *areolar tissue*, giving softness and suppleness to that tissue; the watery exhalations from the *skin* and *mucous membranes*, a mere physical evaporation; and the exhalation of the *aqueous* and *vitreous* humours of the eye, two of its transmitting and refracting media.

The *follicular secretions* are divided into two classes,—the *mucous* and *cutaneous*. In the first division, besides the ordinary follicles which secrete the lubricating mucus, and which are seen generally existing in mucous membranes, there are included the numerous glandulæ of the intestinal canal. In the *stomach* are the simple and compound *gastric follicles*, opening into little pits or depressions in the mucous membrane; these follicles secrete the *gastric juice*. In the *duodenum* are the *glands of Brunner*, seated in the *sub-mucous*

these consist of numerous minute lobules, with a common
ry duct. The nature of their secretion is unknown. In the
n and more particularly in the *ileum*, are the agminated
*of Peyer*, which consist of a cavity covered over with an
ely thin membrane, and having no excretory duct; their
n probably escapes through the medium of cells developed
membrane. These glands or follicles are supposed to secrete
rescent elements of the fæces. Throughout the whole intes-
act, especially in the small intestines, are found the follicles
erkuhn, which secrete the thick, tenacious mucus to lubri-
ese parts. In the cœcum and lower part of the rectum, are
er of simple and large follicles, producing slight elevations
surface of the mucous membrane. These are always most
nt where most mucus is required. The glands of Du-
and Nabothi, in the vagina and cervix uteri, are also lubri-
mucous follicles; as are also the glands of Cowper, and the
e in the male. The *tonsil glands* are considered by some ana-
and physiologists as composed of numerous mucous follicles
the same function, viz., to lubricate the parts on which they
ced.

*cutaneous follicular secretions* include the *meibomian*, *ceru-*
, *sebaceous*, and *sudoriferous*. The *meibomian follicles* are
in the substance of the tarsal cartilage, and secrete a gummy
lubricate the edges of the lids. The *ceruminous*, are seated
the skin of the auditory meatus, and consist of a tube con-
upon itself. They secrete a resinous substance, nearly solid,
ended to lubricate the external meatus. The *sebaceous* matter
skin is secreted by innumerable minute, branched follicles,
by a narrow orifice. These sebaceous glands generally open
e follicles of the hairs. By these an adipose secretion
ed out upon the skin, destined to protect it from the action of
and air. They are sometimes the seat of a minute parasite,
he *demodex folliculorum*.

*perspiration* is formed by small tubes of peculiar conforma-
ry much convoluted, and seated just beneath the cutis vera,
ring out their secretion by minute pores upon the epidermis.
cts pass through the epidermis and cutis vera in a spiral di-
, and their openings upon the epidermis, which are seen
he elevated lines of the skin of the palm and sole, are called
(Fig. 21.) According to Mr. E. Wilson, the number of
weat-glands in the whole surface of the body is about *seven*
*s*, and the conjoined length of the perspiratory tube 28 *miles*.
secretion from these glands is continually taking
usually evaporated as fast as it is formed it does
. If, however, from excessive secretion, or a n
the atmosphere, it is not carried off as fast as fo

cumulates upon the surface, constituting the *sensible* perspiration. It has usually an acid reaction, which is due to the presence either of acetic or lactic acid. It contains also a small amount of animal matter, and some salts, principally *chlorides*.

Fig 20.[*]

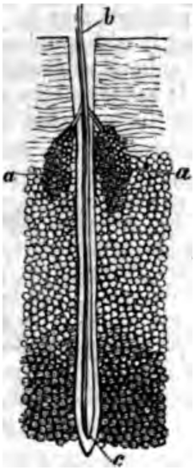
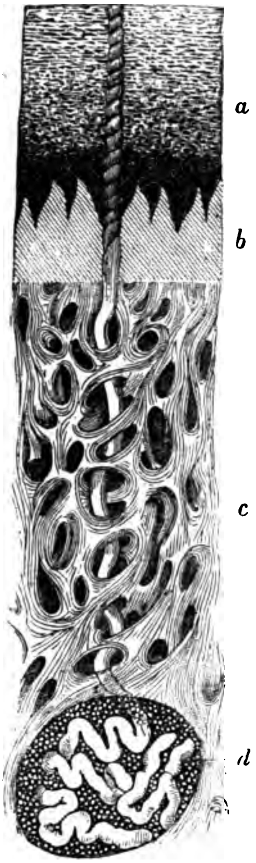


Fig. 21.[†]



The entire amount of fluid insensibly lost from the cutaneous and pulmonary surface is estimated at 18 grs. per minute; of these 11 pass off by the skin, the remainder by the lungs. The maximum loss from both sources during 24 hours is equal to about 5 lbs., the minimum 1¾ lb.

The perspiratory secretion is *depuratory*, and vicarious with that of the kidney, both separating the superfluous azotized matters. The amount of solid matter thrown off from the skin in 24 hours is about 100 grains. The amount of fluid thrown off is influenced greatly by external temperature, being greatest when it is elevated, the object of which increase is to keep down the temperature of the body by *evaporation*. It is also influenced by general

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[*] **Fig. 20.** *a a*. **Sebaceous follicles.** *b*. **A hair, with its follicle** *c*, **surrounded by fat-cells.**

[†] **Fig. 21.** *a*. **Epidermis.** *b*. **Upper layer of cutis vera** *c*. **Cutis vera.** *d*. **Sweat-gland surrounded by fat-cells, with its duct running spirally through the layers of the skin.**

ons of the vascular and nervous system, though the manner
yet well understood.
eculiar glandule, resembling the sudoriferous, but larger, has
been described as existing in the axillæ; these are called the
*rous* or *miliary*, and probably serve to secrete the character-
lour of those parts. The odorous principle may be detected
d which has been dried, by treating it with sulphuric acid:
is said to differ so much in different animals as to afford a test
ich their blood can be recognised. It has even been said that
od of the female can by this means be distinguished from that
male.

## GLANDULAR SECRETIONS.

*lachrymal secretion* is formed by the gland of that name,
seat and structure are described in the *anatomical* division.
ne of the *granular* glands, and pours its secretion upon the
of the conjunctiva to cleanse and lubricate. The lachrymal
esembles dilute serum deprived of a great part of its albumen.
constant secretion, and is absorbed by the open orifices of the
ducts, and carried into the nose as fast as it is poured out.
use of this absorption is probably capillary attraction, assisted
syphon-like action of the nasal duct. This secretion is greatly
ced by the emotions.

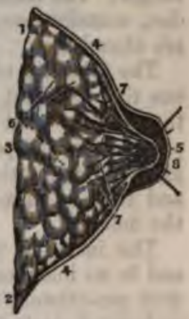
*salivary secretion* is formed by the *Parotids*, *Submaxillaries*,
*guals*, and *Pancreas;* the latter is sometimes called the *ab-*
*al* salivary gland. These glands also come under the division
granular glands, being composed of aggregated follicles, dis-
ng into an excretory duct.

salivary secretion is not necessarily constant: it takes place
g the movements of mastication, and when any irritant is taken
he mouth. It is alkaline in its reaction, and contains among
ingredients, a peculiar animal principle, analogous to pepsine,
*ptyaline*, which seems to act as a ferment, since by it starch
e converted into sugar, and sugar into lactic acid. A consider-
roportion of saline and earthy matter exists in the solid residue
saliva; this is nearly the same as that which the blood contains.
rtar of the teeth consists principally of one of these, the earthy
hates, held together by a little animal matter. If the alkalinity
saliva be destroyed, it loses its converting power on starch;
f acidulated, it has a solvent power for caseine, animal flesh,
ther albuminous substances. The specific gravity varies from
to 1·009. The *quantity* secreted during 24 hours has been
ted at about 15 or 20 ounces. The *pancreatic secretion* con-
a larger proportion of solid matter than the saliva.

MAMMARY SECRETION is peculiar to the *mammalia*, and is
f those which are destined for special uses in the economy.

The *gland* is found in both sexes, and presents but little difference in them till the period of puberty. It consists of numerous lobules, held together by areolar tissue. Each lobule consists of a series of ducts passing inwards from their termination to the nipple, and then ramifying like the roots of a tree, their ultimate subdivisions terminating in minute follicles. The mammillary tubes are ten or twelve in number; they are straight ducts terminating in the nipple, and having a slight dilatation just before their termination, which acts as a reservoir to receive the secreted milk. The secretion, as in the other glands, takes place in the ultimate follicles, by means of cells, which discharge themselves into the ducts. (Fig. 22.)

Fig. 22.*



The mammary gland of the male is a miniature of that of the female, but it does not undergo any marked increase in size at any particular period, its evolution going on *pari passu* with that of the body. There are some instances on record (one by Dr. Dunglison) of its secreting milk; in Dr. Dunglison's case, the secretion was induced by the individual applying the children entrusted to his care, to the breasts during the night.

The milk consists of water holding in solution sugar, various saline ingredients, and a peculiar albuminous substance called *caseine*, and having oleaginous particles suspended in it. By allowing the milk to stand, the oil-globules will come to the top, constituting the *cream;* this includes also a considerable amount of caseine, with the sugar and salts of the milk. By agitating the cream the envelopes of the oil-globules are ruptured, and it is separated into *butter* and *butter-milk*, the latter containing the *caseine, sugar*, &c. A small quantity of caseine, however, is generally entangled with the butter, which has a tendency to render it rancid, and should be removed by heat.

After the removal of the cream the milk still contains the greatest part of the caseine and sugar; if kept long enough, the sugar is converted into *lactic acid*, which coagulates the caseine, precipitating it in small flakes. The same precipitation may be accomplished by other acids; the most effectual is that contained in the *rennet*, or dried calf's stomach, the active principle of which will coagulate 30,000 times its weight of milk. The sugar may be obtained by evaporating the whey.

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* A vertical section of the Mammary Gland, showing its thickness and the origins of the lactiferous ducts; 1, 2, 3, its pectoral surface; 4, section of the skin on the surface of the gland; 5, the thin skin covering the nipple; 6, the lobules and lobes composing the gland; 7, the lactiferous tubes coming from the lobules; 8, the same tubes collected in the nipple.

proportion of the solid ingredients of the milk is about 110
ı 1000, varying according to constitution, the amount and
er of ingesta, and the time which has elapsed since parturi-

first milk is called the *Protogala*, or *Colostrum*, and has a
ve effect upon the child, owing to the presence in it of
ous yellow granulated corpuscles, called colostrum corpuscles.
roperty soon disappears, however, though occasionally it re-
fter the expiration of twelve months, seeming to indicate that
should be no longer encouraged.
ıan milk contains more sugar and less caseine than that of
, a fact to be remembered in substituting the latter for the
The milk of carnivorous animals, fed exclusively on animal
ntains scarcely a trace of sugar, while the caseine and butter
ndant.
quantity of milk that can be squeezed from either breast at
e is about two ounces. It is not always the largest breasts
rete most milk, since their great size is often owing to the
e of adipose matter. The secretion is often materially
by emotions, &c., so as to become poisonous to the child;
is often rendered medicinal by substances administered to
ther.
instances of vicarious secretion of milk are not numerous;
no instance is there any proof that the elements of the fluid
e-existent in the blood. The secretion sometimes occurs in
ted virgins, widows, and women past the child-bearing period,
as in males.
ETION OF BILE.—The *Liver* is perhaps more universally pre-
roughout the animal scale than any other gland. It is the
gland in the body, weighing from three to four pounds. The
rgan is made up of a vast number of minute *lobules*, of irre-
rm, of about the average size of a millet-seed. Each of these
is a miniature gland, containing all the component elements
h the gland is made up, viz.: branches of the hepatic artery
n, branches of the portal vein, branches of the hepatic ducts
reting cells. These lobules are connected together by means
lar tissue and anastomoses of blood-vessels. The *hepatic*
s distributed in a capillary form upon the walls of the hepatic
ınd upon the trunks and branches of the portal and hepatic
it is therefore probably destined for the nutrition of the or-
d not to supply materials for the biliary secretion, at least
has become venous, by traversing the capillary system.
he capillary network the blood passes into branc
ein, and thence into the hepatic veins; for when a
s thrown by Mr. Kiernan into the hepatic art
ecame filled, but not the hepatic. The *vena*

in a capillary form *between* the lobules, and hence is called the *interlobular vein*, sending capillary twigs inwards, which converge towards the centre of the lobule, to form the *hepatic* or *intralobular vein*. (Fig. 23.) These latter terminate in the larger trunks, which pass along the bases of the lobules, collecting from them their venous blood; these are called by Mr. Kiernan *sublobular veins*. The main trunk of the hepatic vein terminates in the ascending vena cava. The *hepatic ducts* also form a plexus, which surrounds the lobules, connecting them together, and sending branches towards the interior of each. Their mode of termination, and their relation to the *hepatic cells* forming the parenchyma of the gland, are as yet unexplained. These *cells* of the liver, which are the real agents in the secreting process, are of a flattened spheroidal form, lying in piles, which seem to be directed from the circumference to the centre of each lobule. Their diameter is from 1-1500th to 1-2000th of an inch; they have a distinct nucleus, and a well-marked biliary tinge, and contain a granular amorphous matter with a few small adipose granules. They are easily obtained in a separate condition by scraping a piece of fresh liver.

Fig. 23.*

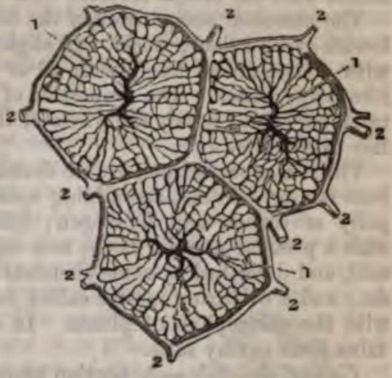
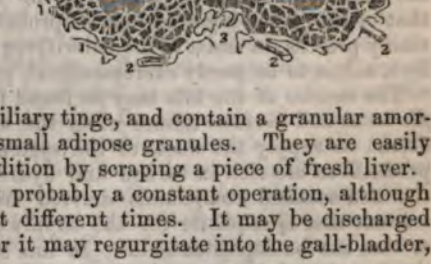


Fig. 24.†



The secretion of bile is probably a constant operation, although it may vary in quantity at different times. It may be discharged at once into the intestine, or it may regurgitate into the gall-bladder,

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* Horizontal section of three superficial lobules, showing the two principal systems of blood-vessels; 1, 1, intra-lobular veins, proceeding from the hepatic veins; 2, 2, interlobular plexus, formed by branches of the portal veins.

† Horizontal section of two superficial lobules, showing the interlobular plexus of biliary ducts; 1, 1, intra-lobular veins; 2, 2, trunks of biliary ducts, proceeding from the plexus which traverses the lobules; 3, interlobular tissue; 4, parenchyma of the lobules.

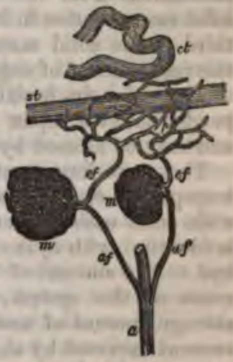
obably does when the intestine is empty and there is no sti-
there to provoke the flow. In the gall-bladder the bile under-
concentration by the absorption of its watery parts; it is also
with the mucus secreted from its walls.
chemical composition of the bile is unsettled. It is of a yel-
green colour, viscid, and slightly bitter. It combines readily
ater, mixes freely with oil or fat, and foams, when stirred,
py water. The proportion of solid matter is usually from 9
er cent.; nearly the whole of this consists of substances pecu-
the bile.
e distinct substances are found in the biliary matter:—*Cho-*
*e*, or bile fat, resembling spermaceti, and consisting princi-
f carbon and hydrogen; *bilic acid*, a compound of soda
peculiar organic body, now regarded in the light of a fatty
d described by some chemists as choleic acid, bilin, picromel,
d a colouring matter called *biliverdin*, a substance identical
e chlorophyll of plants. In addition to these, the bile con-
me earthy salts.
*of the Bile.*—A portion unquestionably passes off with the
this, which includes the colouring matter, is that which would
rious if retained in the blood, and is probably *excrementitious*.
*py portion* seems to act by rendering the fatty matters solu-
l thus enabling them to be absorbed by the lacteals. The
nce of the bile has been shown by Schwann, who pre-
it from passing into the intestine, and found that the ani-
asted, and at last died in a state of great emaciation. The
y also perform another function, as before stated,—the trans-
on of sugar into fatty matter. It is not improbable that this
may take place in the liver; since in animals fed upon grape
his substance has been found in the *portal* vein, but not in
atic. The fatty matter of the bile, when reabsorbed with
the newly-ingested food, is probably carried off in the respi-
rocess, to assist in the calorifying function. The bile, there-
ems to be partly excrementitial, partly recrementitial.
*sources* of the bile may be found in the disintegration of the
*s* and *nervous* tissues when the amount of food is just suf-
to supply the waste of the system, the liver removing such
s as are rich in carbon and hydrogen; and in any excess in
-azotised compounds derived from the food, beyond the
that is requisite for the supply of the respiratory process,
can be deposited as fat. In this elimination of hydro-carbon
r is subsidiary to the lungs. In the fœtus it is the great
nizing agent.
gard to the *kind of blood* from which th
would point to the hepatic artery, altho
nan seem to fix it upon that of the ven

their supporters. Those who embrace the supposition of the secretion from the *hepatic artery*, assign to the vena portæ the office of mixing thoroughly with the blood heterogeneous substances absorbed from the stomach and intestines, before transmitting them to the heart. Those who contend for the secretion from the vena portæ assign to the hepatic artery the office of nourishing the liver, which from its small size, in comparison with the vena portæ, seems more justly to be its function.

SECRETION OF URINE.—This secretion is purely *excrementitial*, being destined to remove certain effete substances from the blood, whose retention would be positively injurious. As it is the function of the liver to remove the superfluous carbon, so it is of the kidney to get rid of the excess of nitrogen in the blood.

The kidney is a *tubular* gland, being formed of uriniferous tubes, both convoluted and straight, the convoluted being found in the cortical portion, the straight in the medullary. The cortical portion is the most vascular, and it is probably the seat of the greater part of the secreting process, whilst the medullary is concerned in carrying the secreted matter; the two parts being in this respect analogous to the cortical and medullary portions of the brain.

Fig. 25.*



In the cortical portion of the kidney are seen a number of small dark points, called Corpora Malpighiana; each of these is composed of a mass of minute blood-vessels very much convoluted upon themselves, like a ball of twine, into which a small afferent branch of the renal artery is seen to enter, and an efferent venous twig to emerge, the points of immergence and emergence being very near to each other. Each of these Malpighian corpuscles is included in a flask-like expansion of one of the tubuli uriniferi, which is dilated to receive it. It is at *this* point, and from the *arterial blood* of the corpuscle, that the *watery* parts of the urine are separated by soaking through the walls of the blood-vessels and tubes, the blood being detained in the corpuscles for this purpose. The *venous twig* after leaving the corpuscle of Malpighi, becomes again capillary, and interlaces with the unriniferous tubes at another point; and at *this* point, and from *venous* blood, as in the vena portæ, the *solid* matters of the urine are separated by the agency of *cells* developed in the walls of the tube. (Fig. 25.)

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* Distribution of the renal vessels; from kidney of horse; *a*, branch of renal artery; *af*, afferent vessel; *m*, *m*, Malpighian tufts; *ef*, *ef*, efferent vessels; *p*, vascular plexus surrounding the tube; *st*, straight tube; *ct*, convoluted tube. Magnified about 30 diameters.

ɔuld thus seem that the function of the Malpighian corpuscles
ɔt rid of the superfluous water in the blood, which, from their
r arrangement, they are well calculated to do. In this re-
hey assist the skin, which is very liable to great variations
amount of fluid it exhales in accordance with the tempera-
the air around.

quantity of *solid* matter eliminated by the kidney has no
ce to the amount of water to be got rid of; being dependent
he amount of *waste* in the system, and upon the quantity of
azotised aliment which has to be discharged through this
l.

average quantity of urine voided in twenty-four hours, by
who do not drink more than the wants of nature require, is
) to 40 oz. Its average specific gravity is 1020. The amount
is less in summer than in winter, on account of the large
ions from the skin in the former season. The quantity of
*atter* varies in health from 3·6 to 6·7 per cent. About one-
f the solid matter is made up of alkaline and earthy salts;
t consists of organic compounds.

urine in health usually presents an *acid* reaction; this de-
however, upon certain conditions furnished by the aliment,
y be altered by a change in the ingesta.

most important constituent of the solid matters is *urea*, a
rent crystalline substance, soluble in water, and combining
cids without neutralising them. In chemical composition it
tical with cyanate of ammonia, viz.: 2 carb., 2 ox., 2 nit., 4
The amount of urea excreted may serve as a measure of the
of the system, especially of the muscular system. The
amount of urea is about 30 parts in 1000 of urine. The
t excreted by children is much greater in proportion to their
ıan in old men. This corresponds precisely with the rapidity
rstitial change at different periods of life.

or *lithic* acid is another important ingredient. It exists in
proportions in the urine of the lower vertebrata than in
alia, in whom there exists only about one part in a thousand
e. It is crystallizable, tasteless, inodorous, and nearly in-
in water. It exists in healthy urine in combination with a
ither ammonia or soda, which latter, according to Liebig, is
l from the bibasic phosphate of soda, which by yielding up a
its base gives the acid reaction to the urine that charac-
its healthy state. Its affinity for the base, however, is so
that it is readily thrown down by any other acid in the urine.
ing to Keller, uric acid is not replaced by *Hipp*
ɔn the administration of Benzoic acid. The amo
not dependent on *waste* or diet, but f
n which it is often deposited from th

with soda, around the affected joints, forming *chalky concretions*. The *urates* are commonly *red*. The presence of *lactic acid* as a constituent of healthy urine is denied by Liebig.

The urine contains also various saline matters, such as muriates, sulphates, and phosphates; the latter supposed to be derived from the waste of the nervous tissue, into whose composition phosphorus enters. The phosphates are commonly yellowish white in colour. The quantity of salts in the urine is never the same in the same individual in like spaces of time; the urine of men, however, generally contains a relatively larger portion of salts than that of women.

The total suspension of the urinary secretion is attended with rapidly-fatal results, the patient dying with symptoms resembling those of narcotic poisoning.

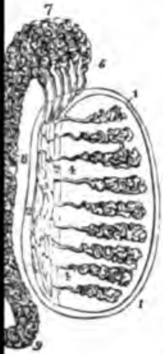
Besides the essential constituents already mentioned, the urine often contains accidentally-mixed substances, such as articles of food, of drink, or of medicine, which pass into it unchanged or changed, and can sometimes be detected in it in an inconceivably short time after administration.

This apparent mystery has been explained by M. Bernard, who has demonstrated that there is a direct communication between the vena portæ (which, it will be remembered, receives the products of absorption from the stomach) and the inferior cava, distinct from the communication that exists between the portal and hepatic veins in the liver. During digestion, when the portal system is gorged with blood, a portion of it passes through these collateral branches into the vena cava, thereby greatly facilitating the flow of the remainder through the portal vein. That portion of blood that has been carried into the vena cava ascendens is forced downwards towards the kidneys by a set of muscular fibres in the walls of this venous trunk, commencing at the diaphragm and extending down as far as the renal veins. When these fibres contract, the blood cannot pass upwards to the heart, because the right cavities of that organ are already gorged with supplies from other sources; it must, therefore, descend. It is prevented from passing into the iliac and crural veins by a valve at the opening of the renal veins, which shuts down under the downward current, and thus the blood is compelled to enter the renal veins, which, as well as the inferior cava, can be seen to pulsate under the muscular contraction. Thus it is that many substances absorbed from the stomach during digestion reach the portal system, and pass from thence to the vena cava and *renal veins* without going the round of the circulation. In this way is explained the frequent innocuousness of poisonous agents administered during digestion. During digestion there is no circulation in the kidney, the blood being carried into it by both arteries and veins; the urine therefore will vary with the food that is taken, being acid after eating animal food, and alkaline, after a vegetable diet.

ing the time that the stagnation and downward current are place in the vena cava ascendens, the blood from the lower ities reaches the heart through the *vena azygos*, which has hown to be equal to the duty of establishing the collateral tion in cases of obstruction of the vena cava by tumours.

SPERMATIC SECRETION is formed by the testis, another gland consisting of lobules formed of convoluted seminiferous The number of lobules is about 450 in each testis, and that of tubules about 840. The different parts may be seen in Fig. 26. The diameter of the tubes is generally very uniform; they anastomose freely with each other without increasing in size. The testes originate in the lower part of the corpora woolfiana, in the embryo, while the kidneys spring from the upper and outer parts. They begin to descend into the scrotum about the middle of pregnancy; at the seventh month they reach the inner ring; in the eighth they enter the passage; and in the ninth they descend into the scrotum. Sometimes one or both remain in the abdomen, without, however, interfering with their function.

Fig. 26.*



The sperm is a thick, tenacious, grayish fluid, having a peculiar odour called *spermatic*, probably dependent on the secretions mixed with it. It is difficult to analyze it, in consequence of its admixture with the secretions of the prostate and Cowper's glands. It is alkaline in its reaction, and contains en and a peculiar principle called *spermatin*. The so-called atozoa are developed in the interior of the spermatic cells, e set free by their rupture before they leave the tubuli of tis. They are supposed to correspond with the pollen-tubes nts, and are probably the agents by which the fecundating als of the male are brought into contact with the elements d by the female. They seem to be essential to the reproe process. The sperm also contains *seminal granules*, the of production of which corresponds with that of other glands. lts that are found in the sperm are muriates and phosphates, lly the latter. The secretion takes place about the 14th or ear, and continues till about 60 or 65; and during the whole s time is much under the influence of the nervous system.

ew of the minute structure of the testis; 1, 1, tunica albuginea; 2, 2, corpus highm; 3, 3, tubuli seminiferi convoluted into lobules; 4, vasa recta; 5, rete testis; 6, rentia; 7, coni vasculosi constituting the globus major of the epididymis; 8, body ididymis; 9, its globus minor; 10, vas deferens; 11, vasculum aberrans or blind

The *Spleen*, *Thymus*, and *Thyroid glands*, and *Supra-renal Capsules*, are called *Glandiform Ganglia*, sometimes *Vascular Glands*. They all act as diverticula to the circulation in their neighbourhood; the spleen to the portal circulation, the thymus to the lungs in fœtal life, the thyroid to the cerebral circulation, and the supra-renal capsules to the kidney. They all seem to share likewise in the preparation of the nutritive materials of the blood, assisting in this respect the lymphatic system, to which they seem to be appendages.

## CALORIFICATION.

Is that function by which the *heat* of organized beings is generated. The *source* of this heat has long been a disputed question among physiologists. From the fact that plants are capable of generating an amount of heat, sometimes far above that of the surrounding medium, an unequivocal indication is given that we are to look for its source in the organic functions and not in those of animal life. In examining the phenomena in plants which bear any relation to this source, we at once perceive that an absorption of oxygen and extrication of carbonic acid are continually taking place (constituting the respiration of plants), and that these processes occur with great activity at the time when the evolution of heat is most remarkable,—that of germination and flowering.

In animals, an approximation may be perceived between the amount of oxygen consumed and of carbonic acid given off, and the amount of heat liberated. Some physiologists have thought that this carbonic acid was formed in the lungs, and the resulting heat distributed to the system by the arterial vessels, they having a greater capacity for heat than the veins; but it has already been shown that the carbonic acid is formed in the tissues and not in the lungs; as the latter, therefore, cannot be the point at which the heat is generated, it must be evolved throughout the system. Exercise, or any increase in the nutritive operations of a part, is always attended with an elevation of temperature, as well as an increase in the extrication of carbonic acid.

The formation of carbonic acid by the union of the oxygen absorbed from the air with the carbon set free from the body, is the main source of the heat generated within the animal system. The amount of carbon consumed in 24 hours is not sufficient, however, to account for *all* the heat liberated; we must therefore look to other sources. That it is not *dependent* on nervous influence is evident from the fact that the process occurs in vegetables. Perhaps the formation of the various secretions,—fluids having a less capacity for heat than arterial blood,—may be accompanied with the elimination of some latent heat. It is also suggested that the union of oxygen with hydrogen, phosphorus and sulphur, and the conversion ɔlastic fluids into solids, may likewise explain the source of ſ the heat that is unaccounted for.

the *cutaneous respiration* is subservient to the maintenance ıeat is evident from the fact that if the hair of rabbits be off, and the surface covered with varnish, the temperature ly falls.

ıses that involve an accelerated pulse and augmented respira- ɪ generally accompanied with elevation of the temperature. ıverse is also true. The ordinary temperature of the human ınges from 98° to 100° Fahr., varying but a few degrees r below when the temperature of the surrounding medium ted or depressed.

is able to resist high degrees of temperature (provided the ıding air be dry), by the evaporation of the perspiratory n from the surface of his body. The less the age of the ual, the less is his ability to maintain an independent tem- e; the human infant in this respect resembles a cold-blooded

## REPRODUCTION.

ƆBSTETRICS, in which this function is treated of.

## IAL FUNCTIONS, OR FUNCTIONS OF RELATION.

*Animal* functions are so called because they are peculiar to ıss of organized beings. They render the individual conscious rnal impressions, and capable of executing spontaneous move- and are dependent for their exercise on the existence of a ɜ system. They are thus classified:

1st. *Sensation.*
2d. *Muscular Motion.*
3d. *Mental Manifestation.*

ıs been shown (pages 41–42) that into the composition of vous structure two distinct kinds of matter enter, viz.: the · *vesicular*, and the *white* or *tubular*; that these two kinds ıot only in structure and colour, but also in *function*, the r *vesicular*, being a generator of nervous influence, and the ıe carrier of this influence to the various parts of the body. ɪn of these two kinds of matter constitutes a *ganglion*, or *centre.*

fundamental idea of a nervous system consists of a ·e, thus composed, and a set of trunks com ed of *lar* matter, connecting the central org ſ the fabric. These trunks or branches *sensory surfaces* or *organs*, and to the *muscles* or *motor organs*. The *first* receive and convey impressions *from* the periphery *to* the centre, and are hence called *afferent*. The latter convey *motor* influence *from* the centre *to* the periphery, and are hence called *efferent*. The first are sometimes called *sensory*, from their connexion with *sensation*; the latter are likewise sometimes designated *motory*, from their connexion with muscular contraction.

The *functional activity* of the nervous system is mainly dependent upon the due supply of oxygenated blood; this is especially necessary at the points at which changes *originate*, not seeming so necessary for the mere conduction of impressions. In accordance with this, we find the *centres* and the peripheral extremities of *afferent* nerves always duly supplied with *arterial blood*; any interruption to its supply being attended with an immediate arrest of their functions. On the other hand, any *increase* in the supply of a part is attended with an exaltation of its function, as is seen in *active congestion* of the brain and spinal cord. It is now a generally-received physiological truth, that the functional activity of the nervous system is mainly dependent, not only upon the due supply of arterial blood, but also upon the *combination of its oxygen with the elements of the nervous structure.*

For physiological consideration the nervous system may be divided into *three* great divisions, the *Cerebro-spinal*; the *Reflex*, or *true spinal*; and the *Great Sympathetic.*

The *Cerebro-spinal* includes the cerebrum and cerebellum, with the *sentient* and *motor nerves* that run to and proceed from them along the base of the brain, or along the spinal marrow, to every part of the system. It presides over *sensation* and *voluntary motion.*

The *Reflex*, or *true spinal*, includes the *gray matter* of the *medulla oblongata* and *spinalis* as its *centre*, and a peculiar set of fibres running to and proceeding from these centres, called *afferent* or *excitor*, and *efferent* or *motor*. It presides over *involuntary* or *excited movements.*

The *Great Sympathetic*, or *ganglionic*, consists of a series of ganglia on each side of the vertebral column, extending from the base of the cranium to the os coccygis, and communicating both with the spinal and encephalic nerves, sending its branches along the arteries and particularly to the organs of the nutritive functions. Its office is supposed to be to bring the functions of organic life into relation or sympathy with those of animal life.

The changes which take place in a nerve of any of the above divisions, when it is in action, are known to us only by the effects they produce on the sentient mind, or on muscular parts. There is no alteration in the physical appearance of the nerve or its fibres, which can be detected by our aided or unaided vision, and yet, from antaneous effect produced by stimuli, and its as sudden cesn their withdrawal, we can refer the phenomena to nothing ly as to a *molecular change*, rapidly propagated along the f a nerve from the point of application of the stimulus. Acto Bowman, a *state of polarity* is induced in the particles erve by the action of the stimulus, which is capable of exn analogous change in other particles, whether muscular or ; whence results the peculiar effects of the nerve's influence. loctrine be tenable, the inference results that the nerves are e *passive* conductors, but that the whole extent of the fibre the stimulated point and the peripheral extremity, or cenmination is the seat of change.

rganic changes produced in a nerve by either *mental* or *phy*muli, develope that remarkable power known as the *nervous* r *vis nervosa*. Of the nature of this power we know nothing. is not *identical* with electricity or galvanism, as was once d, is now established. The following experiments prove f a ligature be placed upon a nerve, its power of conducting influence is lost, while it still continues to transmit elecrrents. Again, if a section of a nerve be removed, and its supplied by an electric conductor, electricity will still pass e nerve, but no nervous force will be propagated through the or to the parts beyond. Lastly, the conducting power of or electricity, according to Matteucci, is not more than onehat of muscle; hence, if the nervous force were electric, it leave the nerve, and follow the muscle in preference. It o be a peculiar power developed in the nervous structure he influence of appropriate stimuli; just as *contractility* is ed in a muscle, under similar influence.

ithstanding then, the great analogy that exists between the power and electricity, we are not warranted in regarding identical; their true relation will be best expressed by sayt they are so closely "*correlated*" that each may be the of exciting the other. For instance, when a current of elecis sent along a motor nerve for a short distance only, it will ontraction in the muscles to which it is distributed; when sensory nerve, it will excite in the sensorium the peculiar ns to which that nerve ministers. So on the other hand, the force is capable of generating electricity, as is seen in the electrical fishes. These "*forces*" therefore would seem to bear e relation to each other as Mechanical Motion, Heat, Light, ity, Magnetism, and Chemical affinity, which although reas *distinct forces*, are fast coming to be considered nvertible; so that one force (A) operating upon matter ceases to manifest itself, but developes an in its stead; which latter (B) may be reconverted into the first (A) or into some other (C) which may reproduce (A or B) or some other (D or E). Thus motion suddenly arrested produces heat; Heat applied to two dissimilar metals produces electricity; Electricity again may develope motion or chemical affinity or light. It is in this way that "forces" are said to be "*correlated*" or mutually convertible.

The functions of particular nerves may be discovered by examining their anatomical distribution. If a nerve is discovered to lose itself entirely in the substance of *muscles*, it may be inferred to be chiefly or entirely *motor* or *efferent*. If, on the contrary, it can be traced to a membranous expansion, *cutaneous*, *mucous*, or otherwise, there is equal reason to believe it an *afferent*, or *sensory* nerve. If a nerve is *entirely* distributed upon a surface adapted to receive impressions of a *special* kind, it may be inferred that it is incapable of receiving or transmitting any others. Such a nerve is said to be one of *special sensibility*, to distinguish it from those that transmit impressions of a general character, and which are called nerves of *general sensibility*.

In considering the functions of the various parts of the nervous system, it is best to begin with the *spinal marrow*, which, with its cranial prolongation, the *medulla oblongata*, may be regarded as the essential part of the *nervous system of vertebrata*.

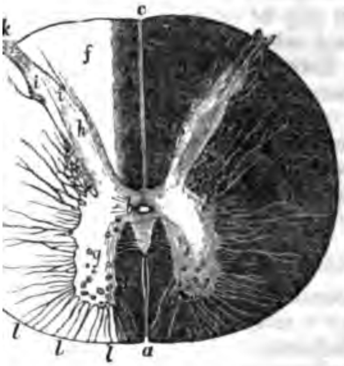
## OF THE MEDULLA SPINALIS.

The *Spinal cord* is to be considered in a twofold light. *First*. As a conveyer of nervous agency *to* and *from* the brain. *Second*. As an *originator* of nervous influence. All the cerebral nerves are subject to the influence of the brain, and all the *spinal* nerves are subject to the same influence through the medium of the spinal cord. As soon as the transmission of this influence is interrupted by division or wounds inflicted upon the cord, impressions on sensitive nerves cease to be propagated to the sensorium, and the brain loses the power of *voluntarily* exciting the action of the *motor* nerves which are given off below the injured point. All the nerves *above* this point, however, still transmit impressions, and are subject to the influence of the brain.

The *white fibrous* matter of the cord is not to be regarded as the common trunk of all the nerves of the body. For although many of the fibres of the roots of the spinal nerves become continuous with the longitudinal fibres that form the white strands of the spinal cord, it is by no means certain on that account that they pass on to the brain, the chief part of the longitudinal strands of the cord being apparently made up of commissural fibres, which form an intimate connexion between its different segments, as in insects. It is easily seen that if the white matter of the spinal cord was directly con-between the roots of spinal nerves and the brain, the ›r of the cord ought to increase as we approach the cervical

spinal cord is traversed by an anterior and a posterior dividing it into *two lateral halves*, each of these also is by two furrows on each side, subdividing it into *three* s. There are, therefore, upon each half of the cord, an *an- middle*, or *lateral;* and *posterior* column. Each spinal nerve ›y two roots, an *anterior* and a *posterior.* The anterior root ıe spinal cord near the *anterior* furrow, and the posterior e *posterior* furrow. (Fig. 27.)

Fig. 27.*



The functions of these two roots are now established. The posterior, which is distinguished by having a ganglion upon it, is the afferent root. Part of its fibres run on to the brain, conveying impressions to that organ; part terminate in the gray matter of the spinal cord, in like manner conveying impressions to the latter. In a word, the posterior root is the *sensory* and *excitory root.*

The *anterior* is the *effe- motor root.* Part of its fibres come from the brain, convey- ıntary motion; part have their origin in the gray matter of ıal cord, and are conveyers of *excited* motion from that centre. ibres of both roots which are unconnected with the brain, ıte the system to which reflex actions are due, and, with the ıtter of the spinal cord, constitute *a distinct nervous circle.* the afferent or excitor fibres, after traversing the *gray* sub- pass out on the same side as the efferent or motor; whilst portion crosses to the *opposite* side, and forms part of *its* trunks. Each spinal nerve, then, contains at least four sets s—

*nsory* bundle, passing upwards to the brain.

*notor* set, conveying the influence of volition and emotion wards *from* the brain.

---

ꞅerse section of human spinal cord, close to the third and fourth or ›r columns. *i*, *i*. Gelatinous substance of the posterior horn. *k*. I ›d anterior root. *a*. Anterior fissure. *c*. Posterior fissure. *g*. Ant ›r. *e*. Antero-lateral column (from *k* to *a*.)

III. A set of *excitor*, or centripetal fibres, terminating in the true spinal cord, or ganglion, and conveying impressions *to* it.
IV. A *motor*, or centrifugal set, arising from the same ganglionic centre (or true spinal marrow), and conveying the motor influence reflected *from* it to the muscles.

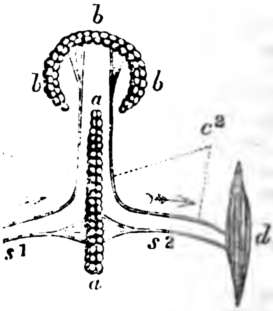
Of these, the *first* and *third* are united in the *posterior* or *afferent root*; the *second* and *fourth* in the *anterior* or *efferent root.*

The functions of the I. and II. bundles have been treated of when speaking of the spinal cord, as a conveyer of nervous influence to and *from* the brain. The III. and IV. are now to be considered in connexion with the cord as an *originator* of nervous influence. These latter, with the gray matter in the centre of the cord, constitute the *reflex system.*

The spinal cord has, in virtue of the gray matter in its composition, or the ganglionic cells collected in its interior, certain properties which characterize it as a central organ. It has a proper inherent motory power, which it communicates to its nerves independently of the brain, a fact which is proclaimed by the state of permanent contraction of those muscles, the sphincter, for example, which depend most immediately on the spinal cord. If an animal be stunned by a blow upon the head, or even decapitated, in some instances, it will still retain for some hours the power of moving the extremities when the integument is pinched, but without the least consciousness, or anything like volition; the motions are automatic, and proceed directly from the spinal cord, in consequence of an excitement or stimulation of its substance effected through the fibres of the spinal nerves that terminate in its gray substance; the motions are purely *reflex*;—in other words, motions which arise from stimuli conveyed to the spinal cord by centripetal or *afferent* nerves, which stimuli are reflected from the cord by centrifugal or *efferent* nerves.

These movements will also continue if the spinal cord be cut across, so as to make two segments, one for the upper and one for the lower extremity; each pair of members may be excited to movement by stimuli applied directly to themselves. The same phenomena are witnessed in the human subject when the spinal cord has suffered injury, or disease, in the middle of the back, provided the lower segment remain sound, and its nervous connexions with the limbs are uninjured. These facts prove that sensation is *not* a necessary link in the chain of reflex actions, all that is required being an *afferent* fibre, capable of receiving the impression and conveying it to the centre; a *ganglionic centre*, composed of vesicular nervous substance into which the afferent fibre passes; and an *efferent* fibre, capable of transmitting the motor impulse from the ganglionic centre to the muscle which is to be thrown into contraction (Fig. 28.)

Fig. 28.*



**There is scarcely any evidence of a disposition to reflex movements of the limbs of the** human body during health, or in the waking condition, these movements being restrained by the controlling influence of the brain. But when the spinal cord is in a state of unnatural excitability, as in tetanus and in hydrophobia, or during the presence of strychnine in the system, or when the communication of cerebral influence to the limbs is cut off by disease of the spinal cord or brain it-
sms may be excited in the extremities often by the slightest
It is to be understood in this explanation of the reflex sys-
it the spinal cord has the power of reflecting the action of
e nerves upon the motor nerves, without itself perceiving the
ion, in other words, without possessing sensation, that being
on exclusively of the brain.
probable that all convulsive movements are produced through
ıcy of the spinal cord and medulla oblongata, either by irri-
eated in the cord itself (*centric irritation*); or by causes
t a distance, the irritation of which is transmitted to the
ord (*eccentric irritation*).
*anglionic system* of the lower orders of animals does not
ond with the *great sympathetic* or *ganglionic* of the higher
ter system existing only in those of most perfect develop-
but with the *reflex* or *true spinal*. In the lower orders, the
are scattered over various parts of the body, in the leech
the mouth; in the higher, they are collected into one common
the *spinal cord*.
gard to the *functions of the columns of the cord*, nothing
is settled. In the opinion of some physiologists (Bellinger
lentin), besides being concerned in sensation and motion,
ie *posterior column* is irritated, at the point where the nerves
r extremity are given off, that extremity is *extended;* and
en the *anterior* is irritated, the extremity is *flexed*. Accord-
others (Todd and Bowman), if it could be proved that the

am of the origins and terminations of the different groups of nervous fibres: a a.
substance of spinal cord. b b. Vascular substance of brain. c. Vasc
ıcement of afferent nerve, which consists of $c^1$, the sensory nerve
$s^1$, the spinal division, or excitor nerve, which terminates in the
be spinal cord. On the other side is the efferent or motor nerve, c
–$c^2$ the cerebral portion conveying voluntary motion, and $s^2$, the s
the reflex power.

anterior roots were exclusively connected with the antero-lateral columns, and the posterior roots with the posterior columns, then there would be ground for the belief that the functions of the columns correspond with those of the roots; but nothing is more certain than that both roots are connected with the antero-lateral columns; and there is a doubt as to whether the posterior roots have any connexion at all with the posterior column. Hence they are disposed to believe that the antero-lateral columns are both *motor* and *sensitive*. They are also disposed to believe that the posterior columns have a function different from that usually assigned to them. They may be in part commissural between the various segments of the cord, and in part subservient to the function of the cerebellum in co-ordinating and regulating the movement necessary for perfect locomotion.

## FUNCTIONS OF THE MEDULLA OBLONGATA.

The brain and spinal cord act on each other through the medium of the Medulla Oblongata; hence the importance of a knowledge of the course of the different columns or bundles of fibres of these parts. It consists of *four* principal parts. 1st. The *Anterior Pyramids*, or *Corpora Pyramidalia*; 2d. The *Olivary Bodies*,

Fig. 29.*

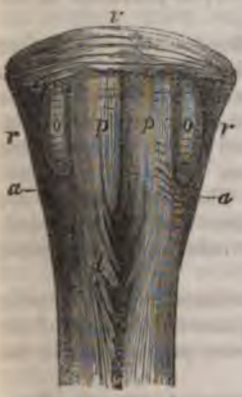
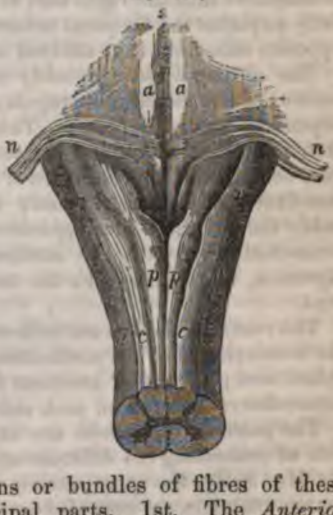


Fig. 30.†



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[*] Front view of medulla oblongata. *p p*. Pyramidal bodies, decussating at *d*. *o o*. Olivary bodies. *r r*. Restiform bodies. *a a*. Arciform fibres.

[†] Posterior view of medulla oblongata. *p p*. Posterior pyramids. *r r*. Restiform bodies, composed of *c c*, posterior columns, and *d d*, lateral part of antero-lateral columns. *a a*. Olivary columns, as seen on the floor of the fourth ventricle. *n n*. Fibres of seventh pair of nerves.

*pora Olivaria;* 3d. *Restiform Bodies,* or *Corpora Resti- ;* sometimes called *Processus a Cerebello ad Medullam Ob- ım ;* 4th. The *Posterior Pyramids,* or *Corpora Pyramida- ıteriora.* (Figs. 29 and 30.)

*gray,* or *vesicular matter,* in this portion of the nervous is principally aggregated in three pairs of ganglionic centres, ·h the *anterior* forms the nucleus of the olivary body, the of the restiform, and the *posterior* of the posterior pyramidal. onsidering the functions of these parts it is impossible to e them completely, they are so closely connected with each and the functions of one part are so readily affected by any in those of the others. In tracing the four divisions of the *a oblongata,* the following are found to be their connexions ıe brain.

*anterior pyramids,* which consist entirely of fibrous structure, said to connect the *motor* fibres of the cerebral hemispheres, ıe antero-lateral columns of the spinal cord. They have also ·xion with the cerebellum. Part of their fibres decussate, a ortion of those that proceed from the right hemisphere pass- ·r into the *left* side of the cord; and those from the left here into the right side of the cord,—an arrangement which xplains the frequent occurrence of paralytic affections on the e side from that affected in the brain.

*olivary bodies* probably constitute the essential portion or of the medulla oblongata, that on which its power as an in- ent centre depends. This opinion seems supported by the ıat these bodies and the central portion of the medulla oblon- ntain that intermixture of *vesicular* and *fibrous* matter which utes the main character of a nervous centre. It is pro- he centre of the *respiratory nerves.* The olivary bodies are ted above with the cerebral hemispheres and corpora quad- ıa, and below with the antero-lateral columns of the spinal

*restiform* bodies are believed to be associated in function with nispheres of the cerebellum, and the *posterior columns* of the cord; a band of arciform fibres, however, passing over to the lateral column on each side.

*posterior pyramids* are supposed by some to have the func- connecting the different segments of the cord with each other. . Solly, the gray nuclei, situated immediately beneath the ventricle, are regarded as the ganglia of the sense of hearing. medulla oblongata, has the general properties of the cord. It has the same property of *reflection,* ind degree than any other part of the nervous system which arise from it are more prone than any otl

It belongs also to the motor apparatus, and has so great an influence on the production of motion, irritation of it exciting convulsions in the whole trunk. The most important motory influences of the medulla oblongata, however, are those that subserve *respiration* and *deglutition*, both of which, respiration more especially, depend upon it. All the rhythmical motions of respiration, such as laughing, yawning, sighing, &c., depend upon it. In considering these lines of communication, as establishing connexions with the encephalon above and the spinal cord below, it will be seen that there are two sets; one forming the restiform bodies, which connect the cerebellum with the posterior columns of the spinal cord; whilst there is another division, which comes into connexion through the olivary and pyramidal bodies, with the anterior and antero-lateral columns. The latter fibres may be considered as forming two principal tracts, the *sensory* and the *motor;* these being so named from the character of the nerves which arise in their course. The *sensory* tract passes upwards from the posterior columns of the spinal cord, and the posterior part of the lateral to the thalami optici; in the upward course it receives the sensory root of the fifth pair, and while passing through the pons varolii undergoes partial decussation; it is obviously continuous below with the tract from the posterior roots of spinal nerves. The *motor* tract may be regarded as descending from the corpora striata and tubercula quadrigemina into the *anterior* and *antero-lateral* columns of the spinal cord; in its course it gives off the roots of all the motor nerves usually considered as cranial, and the greater part of its fibres undergo decussation below the pons varolii. The *medulla oblongata*, therefore, is to be regarded in a twofold light: *first*, as a medium of communication between the higher parts of the *encephalon* and the *spinal cord;* second, as an independent nervous centre for the reflex movements that issue from it, more especially those of *deglutition* and *respiration*.* The different tracts described above are seen in Fig. 31. It is doubtful how far the medulla oblongata participates in sensation (as alleged by Desmoulins, Magendie, Flourens). Any conclusion in this direction from experiments must be unsatisfactory, inasmuch as all the phenomena that have been noted are readily referred to reflex actions.

All the psychological excitements or faculties,—affections, passions, &c., are realized, or made manifest by means of the medulla oblongata; and in those diseases which mental emotion is apt to give rise to, many of the symptoms are referable to affections of the medulla oblongata.

The chief *excitor* nerve of the respiratory movements, is the *afferent* portion of the par vagum; the *afferent* portiondof the fifth is

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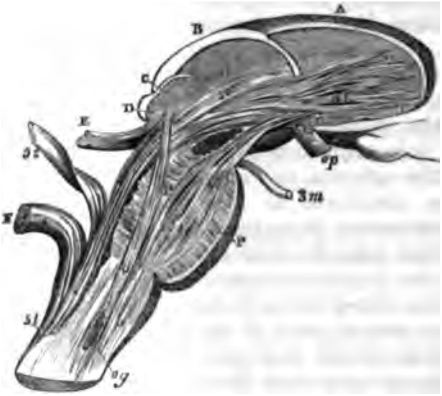
* Carpenter's Elements, third Amer. edit., p. 506.

›owerful excitor. The chief *motor* nerves are the *phrenic* and ›*tals*, which probably *originate* in the medulla oblongata, they issue from the cord at a point lower down. Several

Fig. 81.*



pinal nerves are concerned in the motor portion of the respi- process, as are also the facial nerve, the motor portion of the ;um, and the spinal accessory.

ıe movements of *deglutition*, which are purely *reflex*, the chief is the afferent portion of the *glosso-pharyngeal*, assisted by .nches of the *fifth*, distributed upon the fauces. The *motor* are the pharyngeal branches of the par vagum, assisted by ial, hypoglossal, *motor* portion of the fifth, and, perhaps, also, tor portions of some of the cervical nerves. The medulla ob- . is also concerned, in its reflex action, in governing the aper- the glottis, which it does through the agency of the *superior* *:al branch* of the par vagum, the *afferent nerve*, and the *in-* ›r *recurrent laryngeal*, the *efferent* or *motor nerve*.

## ENCEPHALIC GANGLIA.

medulla oblongata is connected superiorly, as was before with certain gangliform bodies, which have also their proper ns. These are the *Corpora Striata*, the *Optic Thalami*, : *Tubercula Quadrigemina*. The *corpora striata*, and the *alami*, whilst both connected with the cerebral hemispheres

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tion of the Medulla Oblongata, to show the connexions of its sev ·iatum; B, thalamus opticus; C, D, corpora quadrigemina; E, com with the cerebellum; F, corpora restiformia; P, P, pons var ml, motor tract; *g*, olivary tract; *p*, pyramidal tract; *og*, olı ·e; 3m, root of the third pair (motor); 5s, sensory root of the fift by commissural fibres, are, in the most marked way, connected inferiorly with separate and distinct portions of the *medulla oblongata;* the *corpora striata*, with the anterior pyramids, and the *optic thalami* with the olivary columns, the central and probably fundamental portions of the medulla oblongata. Thus along the tract that passes from the *anterior pyramids* to the corpora striata, we have none but *motor* nerves: whilst along the tract that connects the olivary columns with the thalami, there are none but *sensory* nerves. The thalami then may be regarded as the ganglionic centres of *common sensation*, standing in the same relation to the sensory nerves, converging from the various parts of the body to the encephalon, as do the optic and other ganglia to their nerves of *special* sensation. On the other hand, the corpora striata are implanted on the *motor* tracts which descend into the anterior pyramidal column; and their connexion with the *motor* function is very generally admitted, from the constancy with which paralysis is observed to accompany lesions of these bodies. From the fact that sensory impressions can be felt, and automatic movements of a higher grade than the simply reflex, can be called into play after removal of the peripheral portion of the cerebrum, provided these ganglia be left untouched, and from the fact of their constituting the mass of the encephalon in the lower animals who manifest consciousness, and execute movements directed by sensation, there can be scarcely a doubt that these ganglia preside over consciousness even in man, the mere superaddition of the peripheral ganglia by no means altering their endowments as present in the lower animals. The movements that result from these centres differ from the ordinary reflex movements in requiring that the impressions which originate them shall be *felt;* hence they are designated as *consensual.*

According to the views above expressed, the corpora striata and optic thalami bear to each other a relation analogous to that of the anterior to the posterior horn of the spinal gray matter. The corpora striata and anterior horns are centres of motion; the optic thalami and posterior horns, centres of sensation.

The *tubercula quadrigemina* are the true optic ganglia, the encephalic recipients of the impressions necessary to vision, which, according to Bowman, are doubtless simultaneously felt by means of the optic thalami; they are also the centres of those movements of the iris which contribute largely not only to protect the retina, but likewise to increase the perfection of vision. Irritation of an optic tubercle on one side causes contraction of both irides.

This is quite in accordance with the fact, that if light be admitted to one eye so as to cause contraction of its pupil, the other pupil will contract at the same time. Whatever other functions the tubercula quadrigemina may perform, they have a sufficiently obelation to the optic nerves, the eye, and the sense of vision. ay therefore be justly reckoned as special ganglia of vision. e base of the brain are found other ganglionic masses, which irect connexion with the nerves of sensation, and appear to nctions quite independent of those of the other components encephalon. Anteriorly are found the *olfactive ganglia*, in re commonly termed the *bulbous expansions* of the olfactory That these are *real* ganglia is proved by their structure ing gray or vesicular matter), their relation to the olfactory their direct proportion of bulk to that of these nerves, and evelopment of the olfactory apparatus. The *auditory ganglia* so clearly made out. In higher animals, and man, the y nerve can be traced into a small mass of vesicular matter ies on each side of the fourth ventricle, which may be conas having a character of its own, and that it is really the nic centre of the auditory nerve. The ganglia of the sense may be considered as existing in the ganglia on the posterior the spinal nerves, and of the fifth pair. As this sense is over the whole body, it would seem to need ganglia in conwith those nerves which receive the tactile impressions. The *y ganglion* is a collection of gray or vesicular matter, imin the medulla oblongata, which is considered by Stilling to nucleus of the glosso-pharyngeal nerve, and to which a porthe sensory root of the fifth pair may be traced.

### FUNCTIONS OF THE CEREBELLUM.

his point there has been, and is still, much discussion. Some ng it as the organ of the sexual impulse; others, as being ed with the function of motion.

development of the cerebellum in the scale of animals bears tion to the energy of the sexual impulse. In the amphibia s and toads) this organ is extremely small, constituting a and lying over the fourth ventricle, and nevertheless the instinct of these animals is proverbial, although they have no organ. The same thing is true of the monkey and the kanoth remarkably salacious, and yet with an inconsiderable ment of the cerebellum. Pathological evidence is also against enological doctrine; instances are on record of partial, and al absence of the organ, without the destruction of the sexual . In the first case the individual was married, and the father ral children. In the other there was a tendency to mastur-

xperiments of Flourens, Hertwig, Rolando, and others er removal of the cerebellum the animals lost the ng the movements necessary for locomotion; stup es was never produced, nor the sensibility of any body destroyed; the power of muscular movements *only* was lost; neither were convulsions ever produced. By the time the last portions of the organ were removed the animals had lost entirely the power of springing, flying, walking, standing, and preserving their equilibrium. All these mutilations were performed without the animal's evincing any sensibility in the cerebellum while it was being removed. There was no loss of volition or sensation, but merely of the faculty of combining the action of the muscles in groups. These facts have led most physiologists to adopt the opinion that the cerebellum has for its function, the *regulation* and *harmonization*, or *co-ordination* of *muscular* movements, especially those of a voluntary character.

This opinion is further substantiated by the observations of Leuret and Lassaigne, which show conclusively that the cerebellum is *larger* in geldings, which are commonly used for draught purposes, and in whom the number of muscles employed is consequently great, than it is either in the mare or stallion, the latter of which is kept especially for the purpose of propagation, and is much less applied to occupations which call forth their motor faculties. The cerebellum is connected with the medulla oblongata and spinal cord by the restiform bodies, and the posterior columns of the cord, and with the mesocephale by the fibres of the pons. Thus this organ is brought into union with each segment of the great nervous centre, upon which all the movements and sensation of the body depend.

### FUNCTIONS OF THE CEREBRAL HEMISPHERES.

The fact of the cerebral hemispheres having a more perfect development in proportion as the animals in which we examine them are higher in the scale of vertebrata, from fishes up to man, and the coincidence of atrophy and the absence of the convolutions on their surface with idiocy, are alone sufficient to indicate that the seat of the higher intellectual faculties must be sought for in this part of the encephalon. The primitive fibres which go to the constitution of the cerebral hemispheres have least of all to do with the simple motory and sensitive operations of the nervous substance. All inquirers agree in representing the hemispheres as altogether insensible; they may be cut, pricked, and either partially or entirely removed without any feeling of pain being excited. Wounds of this part of the encephalon, moreover, give rise to no convulsions; the only constant effect of a deep incision is blindness of the eye of the opposite side, and a state of stupidity. These investigations, while they render more precise the functions of the cerebrum, have also tended to *limit* them.

It has also been shown that this organ is *not essential to life*, that it must be considered as an organ *superadded* for particular purposes; that it has no representative in the lowest classes of animals,

t when it first makes its appearance in fishes, it evidently
s a subordinate part in the general actions of the nervous
 Hence, whatever be its function, it should be remembered
loes not deprive other parts of their independent powers,
h it may keep them in check, and considerably modify their
tation.

xperiments instituted by the same physiologists above men-
go to prove that the cerebrum is the organ of *intelligence.*
s from whom the hemispheres were removed, had constantly
earance of deep sleep, and when irritated resembled in their
an animal just awaking. M. Flourens likens them to an
condemned to perpetual sleep, but deprived even of the
of dreaming. A hen, in which Hertwig had cut away the
eres nearly to the base of the brain, was found to be deprived
, hearing, taste, and smell; it sat constantly in one spot,
s as if dead, until strongly roused, when it moved a few
t neither fed itself, nor drank, nor attempted to avoid
 It is evident from these experiments, and from the effects
ure on the cerebral hemispheres in man, *that they are the*
*the mental functions;* that in them resides the power of
g the mind to particular sensorial impressions,—the faculty
tion.

portions of the cerebral hemispheres that possess these
l functions are the *convolutions.* The complexity of the
tions in the animal scale is in the direct ratio of the advance
ligence. In infancy they are imperfectly developed, and
crease in size goes on simultaneously with the advance of
power. If their growth be arrested, the mental powers are
eeblest kind. In idiots the brain is not only small, but the
tions are exceedingly limited. The *object* of these convolu-
to afford as extensive a surface of the gray or vesicular
in as small a space as possible. By this arrangement, also,
ready access is permitted to the blood-vessels on the one
d a more free communication on the other with the vast
of fibres by which its influence is to be propagated.

evident, that if the surface of the gray did not exceed that
white matter, folds or convolutions would not be necessary,
mple expanse of the former would suffice to cover the sur-
the latter. The existence of convolutions on the surface of
nispheres affords evidence of a large relative amount of the
e or vesicular nervous matter, and their number or com-
is a measure of the extent to which the vesicular surface is
d. Of two brains, equal in bulk, the one that has n
tions has most vesicular matter, and is, physiologically.
tential. It has been calculated that the entire su

the human cerebrum, when the convolutions are unfolded, is equal to about 670 square inches.

The *weight* of the *entire* encephalon in the adult male usually ranges between 46 and 53 ounces; in the female, from 41 to 47 ounces. The maximum is about 64 ounces or *four pounds;* the minimum about 31 ounces, or rather less than *two pounds.* In the idiot it is often much below this, as, for instance, 20 ounces. The cerebral hemispheres alone weigh about *four times* as much as the rest of the cerebro-spinal mass.

The brain is abundantly supplied with blood by the vertebrals and carotids, which anastomose very freely with each other, to obviate the effects of pressure upon either of them. Their course is also a tortuous one, that the impulse of the blood upon so delicate an organ may be avoided.

A certain amount of regulated pressure upon the walls of the vessels of the brain is essential to the proper exercise of its functions. It is known that the amount of blood circulating through the brain varies at different times in accordance with its increased or diminished functional activity, and that the cranial case is not an unyielding one, as its contents would then be invariable. A special provision is made to meet this varying amount of fluid, and to keep up the same degree of pressure upon the organ, in the existence of a fluid beneath the arachnoid wherever the pia mater exists. The amount of this fluid averages about 2 ounces, but in cases of atrophy of the brain, as much as 12 ounces may be obtained from the cranio-spinal cavity; whilst in all instances in which the bulk of the brain has undergone an increase, either from the production of additional nervous tissue, or from undue turgescence of the vessels, there is either a diminution, or a total absence of this fluid. It has been shown by Magendie that the withdrawal of this fluid in living animals always causes great disturbance of the cerebral functions, probably by allowing undue distension of the blood-vessels. It is, however, speedily renewed, and its reproduction restores the nervous centres to their normal condition.

## FUNCTIONS OF THE SYMPATHETIC.

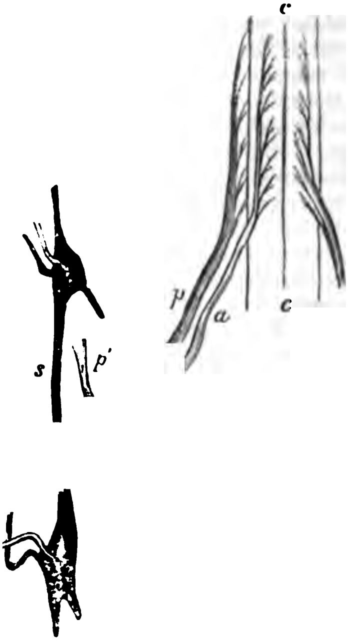
This nerve has been variously called the *splanchnic,, ganglionic, vegetative*, and *organic.* It consists of an uninterrupted chain of ganglia, extending on each side of the vertebral column, from the first cervical vertebra down to the coccyx, and moreover extending upwards beside the cranial vertebræ, and occupying spaces between the bones of the cranium and those of the face. The chains of the opposite sides communicate with each other at various points in the plexuses of nerves that originate from them, and through the *ganglion impar*, a single ganglion in front of the coccyx. A *cephalic* communication is described by Ribes in a *ganglion impar* situated he *anterior communicating artery* of the circle of Willis, and natomists regard the pituitary body in the sella turcica as a n of like description,—a common point of union for the right 't chains at their cranial extremities.

peculiarities of the sympathetic fibres were spoken of when ing the development of the nervous system (page 42).

sympathetic system contains two sets of nervous fibres,—the y white tubular fibres, which it derives from the cerebro-system; and the *gray* or ***gelatinous*** fibres, which belong exly to itself.

ı of these systems thus mingles with the other, the cerebro-spinal transmitting both motor and sensitive fibres into the sympathetic; whilst the sympathetic is represented in the cerebro-spinal system by certain fibres and collections of vesicular matter of its own. (Fig. 32.)

Fig. 32.*



Adopting this view of the compound nature of the sympathetic, it seems to be impossible to regard it either as independent of the cerebro-spinal centres, or wholly depending upon them. It is probably independent of them as regards its gelatinous fibres, but dependent upon them as regards its tubular fibres. It is to be looked upon as a portion of the nervous system, peculiar in its composition, having, as regards some of its constituent fibres, a special relation to the blood-especially the arteries, but being by its other fibres connectı the cerebro-spinal centres. It is also distributed both to t surfaces and to muscles, as to the heart and intestinal ca

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2. Roots of a dorsal spinal nerve, and its union with the sy
ure of the spinal cord. *a. p.* Anterior and posterior roots.
ınction with the anterior branch of the spinal nerve, by

movements in which can be excited by stimulation of the ganglia connected with them. The well-known occurrence of pain in parts supplied by it, proves the existence of sensitive fibres.

The sympathetic thus appears to exercise a threefold office: first that of a sensitive nerve to the parts to which it is distributed; secondly, that of a motor nerve for certain muscular parts; and thirdly, that of a nerve to the blood-vessels. By the last arrangement it may influence nutrition and secretion by its effect upon the contractility of the coats of the vessels. The effect of the emotions operating through this channel upon the blood-vessels is seen in the act of blushing, and also in the pallor that often accompanies them.

Dr. Carpenter thinks that as the sympathetic system is not developed in proportion to the predominant activity of the functions of organic life, but in proportion to the development of the higher division of the nervous system, its office is not to preside over the former, but to bring them into relation with the latter; so that the actions of the organs of vegetative life are not dependent upon it, but influenced by it, in accordance with the operations of the system of animal life.

## SENSATION.

By this term is meant *the perception of an impression.* It is with the brain alone that the mind possesses the relation necessary for the production of sensation. Hence the brain is often called the *sensorium.* Sensations are of two kinds, *external* and *internal.* By the first are meant those that arise from impressions made upon the external surface of the body, as in the senses of sight, touch, or hearing. The *internal* are such as occur within the body, and arise from some alteration in the function of the part, for the time being. Hunger and thirst are internal sensations.

With regard to all sensations, it must be remembered that the change of which the mind is informed, is *not* that which occurs at the peripheral extremity of the nerves, but the change communicated to the sensorium; in other words, sensation does not occur at the point impressed, but in the brain. Hence it happens that sensations often occur from impressions upon a nerve somewhere in its course. This is of frequent occurrence in the senses of sight and hearing, flashes of light being seen, and ringing sounds being heard, when no external stimuli could have produced such impressions. In such cases they not unfrequently arise from impressions made on these nerves in their course from special ganglia to their peripheral termination. This variety of sensations is termed *subjective,* to distinguish them from *objective,* in which the stimuli are derived from without. The most common cause of these subjective sensations is congestion or inflammation in the course of the nerve.

Whenever an impression is made upon a nerve in its course, the

ıstinctively refers it, not to the point impressed, but to the
y termination of the nerve upon the periphery of the body,
.though these terminations should not exist, or should be
le of receiving impressions. Thus, after amputations, the
; are often troubled with sensations which they refer to the
l extremities; and in like manner, after the Taliacotian ope-
all sensations produced by touching the nose are referred to
:head, from whence the flap was taken, until the new vascu-
nervous communications are established.

ctive capillary circulation in a part is essential to its sen-
; any cause which retards this deadens the sensibility of the
is well seen in the benumbing influence of cold. Increased
r action, again, produces a corresponding increase in sensi-
this is seen in the active congestion preceding inflammation.

ıtions are divided into *general* and *special*. *General sensa-*
distributed over all the body; by it we feel those impres-
ade upon our bodies by surrounding objects, which produce
ious modifications of *pain* and *pleasure*, the sense of contact
istance, and variations of temperature. *Special sensation* is
hich arises from impressions of a peculiar character, upon
which are adapted to receive them alone.

intensity of all sensations is very much blunted by frequent
on, excepting in the case of those to which the attention is
larly directed; these, so far from losing their acuteness,
much more cognizable by the mind. Hence arises the
lity of the special senses.

ough there are some stimuli which can produce sensory im-
ıs on *all* the nerves of sensation, it will be found that those,
h any one organ is peculiarly fitted to respond, produce little
ffect upon the rest. Thus the ear cannot distinguish lumi-
ys, nor the eye the undulations of sound; and the same is
the other senses. Hence it may be inferred, *that no nerve*
*ial sensation can, by any possibility, take on the function of*
. *But that each requires its own peculiar stimulus to call it*
*ion, light for the eye, and sound for the ear*, &c.

nerves of *special* sensation have in themselves no *general*
ity; they may be pricked or torn without the individual suf-
ıny pain; they only experience or give rise to their own
r sensations. All the general sensibility that the organs of
ses possess is derived from nerves of general sensibility dis-
l to them. The *special senses* are five in number, viz.:
*Taste*, *Smell*, *Hearing*, *Seeing*. To these some add a *sixth*, the
*ır sense*, or that by which the will can produce, ch
e the amount of contraction in the voluntary muscles.
preciate, by certain sensations originating in the mu
degree of contraction in each.

*organs* of the special senses consist of two parts, a and a *vital* part. The physical part receives and modifies the impression; the vital transmits the impression to the brain. The different transparent media of the eye contribute its physical portion; the *nerve* is the vital portion.

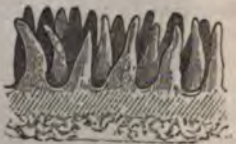
## SENSE OF TOUCH.

Of all the senses, Touch is the most extensively diffused throughout the animal kingdom; it is the simplest and most rudimentary of all the special senses, and may be considered as an exalted form of *common sensation*, from which it arises by imperceptible gradations till it reaches its highest development in some particular parts. It is also the earliest called into operation, and the least complicated in its impressions and mechanism.

The sense of touch is most highly developed in those parts that are most abundantly supplied with sensory nerves. In the lips, the tip of the tongue, and the palmar aspect of the last joints of the fingers, the nerves are both very numerous and superficially distributed, and whilst the epidermic layer is thinner, there is at the same time a greater degree of isolation of the papillæ of the skin between lines and furrows of the epidermis. The number of these lines or furrows is commensurate with the development of the sense. Even in man the acuteness of the sense of touch varies much in different regions of the body, as can be proved by observing the varying distances at which the two points of a pair of compasses can be separately recognised on different parts of the surface; on the points of the fingers they can both be recognised at a distance of one-third of a line, while they require to be separated thirty lines in order that the two points may be recognised over the spine.

The nerves of touch are the same as those of general sensation, viz.: the posterior roots of the spinal nerves, and some fibres of the fifth and eighth cerebral nerves. They are distributed to the tactile papillæ of the skin, small elevations enclosing loops of blood-vessels and branches of the sensory nerves, (Fig. 33), situated on the exterior surface of the cutis vera. The papillæ are covered by the epidermis, which protects them from too violent impressions of external bodies upon them.

Fig. 33.*



In the sense of touch the body to be examined must be brought into contact with the sensory surface. The only exception to this is in regard to the sense of temperature, for which there would seem to be a distinct set of nerves.

The only idea communicated to our minds by the sense of touch, is that of *resistance*. By the various degrees of resistance which the sensory surface encounters, we obtain a knowledge of the hard-softness of a body. When the sensory surface and the sub- touched are moved upon each other, we obtain a notion of on or space. At the same time, by the impressions made he tactile surface, we discover the roughness or smoothness substance. The knowledge of *form* and *weight* is derived by litional assistance of the *muscular sense.*

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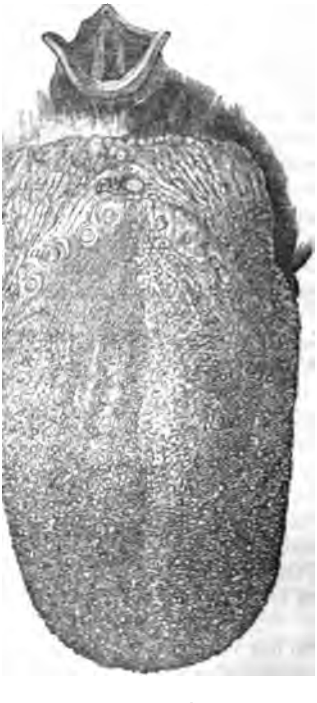
* Papillæ of the palm, the cuticle being detached.

sense of touch is exceedingly educable, as is seen in the case blind, who can be taught to read, and even distinguish co- by its agency.

ressions made upon the organ of touch continue perceptible ie time after the stimulus has been removed; for instance, the g of a smart blow does not soon subside, and the simple con- f an article of clothing often leaves the impression of its e after it has been removed. The *subjective sensation* per- to the nerves of this sense are among the best known. The g of a limb that is "asleep," which commonly depends on pressure on its trunk, may also result from changes in the centre; the same is true of formication, heat, chilliness, itching, and also of pain.

Fig. 31.*



### SENSE OF TASTE.

In the sense of taste, as well as in touch, the substance to be examined must be brought into contact with the organ of the sense, which organ is the mucous membrane of the tongue and fauces. The mucous membrane of the tongue is largely supplied with papillæ of various forms, which are abundantly supplied with nerves and blood-vessels. The papillæ are of three varieties: 1st. The *calyciform* or *circumvallate,* situated at the base of the tongue in a V-shaped line, *a* (Fig. 31, the *fungiform,* on the sides and apex *b*; and the *conical,* or filiform, the most numerous, and most abundant, in the central part, *d.* The latter are

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r surface of tongue. *a.* One of the circumvallate papillæ; *b,* one of the fungiform; papillæ.

supposed to be concerned rather in the sense of touch than of taste. When these papillæ are called into action by the contact of substances having a strong savour, they become turgid and erect, so as to produce a decided roughness on the surface of the organ.

There is no special nerve of taste: the sense seems to be divided between the glosso-pharyngeal and the fifth. The impressions made upon the front of the tongue are conveyed by the fifth; those upon the back of the organ by the glosso-pharyngeal. The first ministers also in general sensibility; the latter conveys the impressions that produce nausea. It is also the afferent nerve in the reflex act of swallowing. The ninth pair is also distributed to the tongue, but it is a *motor* nerve, and not at all concerned in the special sense.

A necessary condition for the exercise of this sense, is solubility of the substance to be tasted; if it be insoluble it merely excites the feeling of contact. The sapid substance should also be moved over the surface of the tongue; by this means the taste is very much heightened. In this respect there is a strong analogy between touch and taste. Taste may also be produced by mechanical irritation or chemical excitation of its nerves. A smart blow of the finger, or galvanism, will often excite a taste, sometimes acid, at others alkaline. A large part of the impression made by sapid substances is received through the sense of smell, as may easily be proved by attempting to taste any substance while holding the nose. In inflammation of the Schneiderian membrane too, we lose the power of appreciating the flavour of bodies through the impairment of the sense of smell.

Taste is an educable sense, as is seen in the case of spirit-tasters, but it is not considered an intellectual one. Its *subjective* phenomena are not so strongly marked as in some of the other senses, and yet we are constantly experiencing pleasant or unpleasant tastes without any apparent cause. Magendie states that dogs, into whose veins he had injected milk, licked their lips as though they tasted it.

The sense of taste is designed to guide us in our search for food; it is therefore placed at the entrance of the digestive apparatus. Impressions of taste remain longer than those of other senses; but the after-taste itself is not always the same as the original.

Cold air deadens the sense of taste, precisely as it is known to do in the sense of touch.

## SENSE OF SMELL, OR OLFACTION.

This sense is designed to acquaint us with the odorous qualities of particles suspended or dissolved in the atmosphere. It is seated in the mucous membrane of the nose, and at the commencement of the respiratory passages, that it may protect them against the entrance of deleterious matters. Its principal use, however, is to

the impressions of taste in conveying intelligence of the pro-
of food.

organ of the sense of smell has no capacity of movement in
n to its ordinary stimuli; the odorous particles are brought
ntact with it in the act of inspiration. These particles are so
is to elude detection by the most delicate experiments. The
mucous membrane of the nose is not endowed with the sense
ll; it seems to be limited to that portion expanded over the
r and *part of the middle spongy bones.* This region is there-
lled the *olfactory region.* It is *to this portion only* that the
*y nerve* is distributed. The other portions of the mucous
ane are supplied with branches of the *fifth pair,* from which
tain their general sensibility. These branches are derived
ie ophthalmic and superior maxillary divisions. When the
rve is diseased, irritating substances may be introduced into
e without discomfort to the patient. Section of the fifth pair
rests the secretion from the mucous membrane, and in that
minishes the acuteness of smell. This nerve is the *afferent*
*tor* nerve in the reflex act of sneezing.

organ of smell is seated high up in the nose, not only to
it from mechanical injury, but that it may be screened from
tact of air either *too cold* or *too dry.* The convoluted ar-
ent of the turbinated bones, with their expansion of mucous
ane, effects this. These parts break the force of the current
warm it, and impart that degree of moisture which is best
ted to aid the solution of the odorous particles on the sentient
to which they are to be applied.

olfactory nerve passes down from the olfactory bulb or gan-
hrough the cribriform plate of the ethmoid bone, and is dis-
l in minute threads having a plexiform arrangement (Fig.
Their ultimate distribution is probably in *loops.*

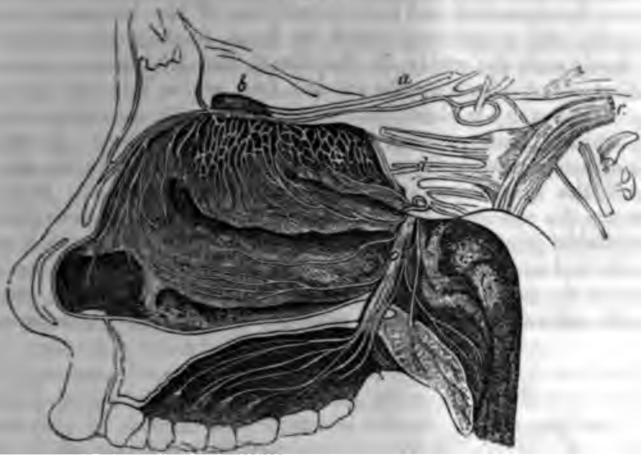
*conditions* requisite for the exercise of the sense of smell are,
tion to the integrity of the nervous apparatus, a healthy con-
of the mucous membrane. If it be dry, or in a raw, irritable
ith a watery discharge, the sense is lost or impaired. This
iarly seen in a *cold in the head.* The substance to be smelt
so be *soluble;* insoluble substances cannot be perceived by
se. When we wish to examine any substance closely, it is
up into the nose with some force, in order that the odorous
s may reach the olfactory region.

sense of smell, although not an intellectual sense, is suscep-
cultivation; by it individuals are often capable of re
and even, as in one instance, to discover their ow
many others.

*ective phenomena* sometimes occur in this s
thers, from irritation by an internal cause.

olfactory bulb, or of the anterior lobe of the brain, has been known to produce them. Muller relates the case of a man, who ever after a fall from his horse, believed that he smelt a bad odour. Whether

Fig. 35.*



substances introduced into the circulation would excite the olfactory nerve to the perception of the odour, has not been ascertained experimentally.

The cavities that communicate with the nasal passages have no connexion with the sense of smell.

## HEARING, OR AUDITION.

By the sense of hearing the mind takes cognizance of the condition of the auditory nerve produced by those oscillations of elastic matter which give rise to the phenomena of sound. The communication of these oscillations to the ear may take place through the air, or through the intervention of some solid conductor, brought into immediate connexion with the organ of hearing. The following account of the organ is condensed from the eighteenth chapter of Todd and Bowman's Physiological Anatomy. The essential part of the organ of hearing is a sac, containing fluid, upon which the nerve of hearing is freely distributed; this sac being in connexion

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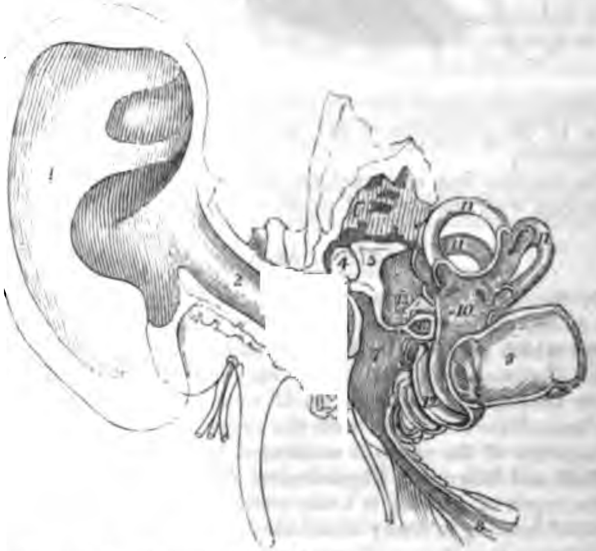
[*] *a.* Olfactory process. *b.* Olfactory bulb. *c.* Fifth nerve within the cranium. *d.* Its uperior maxillary division, anastomosing with the olfactory filaments, and with *s*, branches f the nasal division of the ophthalmic nerve. *o.* Posterior palatine twigs from Meckel's nglion, supplying the soft and hard palate.
The cut represents the outer wall of the nasal fosse, with the three spongy bones and eptum.

e cranial parietes. This is represented in the human subject
small cavity excavated in the petrous portion of the tempo-
ɜ, called the *vestibule.* This, and *three semicircular canals,*
spirally-disposed canal, divided by a partition, constituting
*hlea,* form the *labyrinth.* External to this, and situate
ı the squamous and petrous portions of the temporal bone,
ity, the *tympanum,* which in front further communicates
:ely with the cavity of the throat through an open canal,
*tachian tube,* whereby air has free access into the tympa-
This cavity is closed on the outside by the *membrana tym-*
hich extends over its external orifice as a drum. A small
f bones extends from this membrane to another in the inner
the tympanum (the membrane of the foramen ovale).
re the *ossicles* of the ear. These small bones are articulated
eable joints, and are moved by small muscles, which are
abled to regulate the tension of the membrana tympani, as
of the membrane of the vestibule. Externally is an appa-
r collecting sounds and conducting them to the tympanum,

Fig. 36.*



ıe *external ear,* comprising the free expanded part the
d the *auditory canal,* or *meatus externus.* (Fig. 3

---

llion. 2. Meatus externus. 3. Membrana tympani. 4, 5, 6.
mpanum. 8. Eustachian tube. 9. Meatus internus. 10. V
nals. 12. Cochlea. 13. Stapedius muscle.

The *auditory nerve* is the *portio mollis* of the seventh pair, which is distributed to the vestibule, cochlea, and semicircular canals. Its mode of termination is unsettled. It will be seen from this description of the auditory apparatus that it is divided into three parts. 1st. *External ear;* 2d. The *middle ear,* or *tympanum;* 3d. The *internal ear.*

Sounds may be propagated in three ways: by *reciprocation;* by *resonance;* and by *conduction.* Vibrations of *reciprocation* are excited in a sounding body when it is capable of yielding a musical tone of definite pitch, and another body *of the same pitch* is made to sound near it. Thus, if two strings of equal tension be placed side by side, and one be thrown into vibrations, the other, although untouched, will be thrown into corresponding vibrations. The same is true of membranes as of strings. If a membrane and a string both capable of yielding the same note, be placed side by side, and one be thrown into vibrations, the other will reciprocate. But no membrane or string will reciprocate any tone that is lower than its own *fundamental note,* by which is meant, the *lowest note* which it will yield when the whole of it is in vibration together.

Vibrations *of resonance* occur when a sounding body, as a tuning-fork, is placed in connexion with any other, of which one or more parts may be thrown into reciprocal vibrations, even although the tone of the whole be different, or it be not capable of producing a definite tone at all. If a tuning-fork, whilst vibrating, be placed in contact with a sounding-board, the board will divide itself into a number of parts, each of which will reciprocate the original sound so as greatly to increase its intensity.

*Vibrations of conduction* are the only ones by which sounds can be said to be propagated. If the ear be placed at one extremity of a long board, and the other be lightly struck, the sound will be *conducted* to the ear along the whole length of the board. All media are capable of conducting sound, a vacuum being the only space through which it will not pass. Solids are better conductors than fluids, and fluids than gases. The greatest diminution in the intensity of sound is usually perceived, when a change takes place in the medium from which it is propagated, especially from the aeriform to the liquid.

The *object* of the *external ear* is to receive sonorous vibrations, concentrate and conduct them inwards. The various elevations and depressions of the external ear adapt it peculiarly to catch the sonorous waves arising from opposite quarters. The *auditory canal—meatus externus*—receives the sonorous pulses immediately, and conducts them to the *membrana tympani.* The sound is at the same time strengthened by reflection from the walls of the meatus, and the resonance of the mass which it incloses; the walls of the passage, moreover, are solid conductors of sound.

*se of the membrana tympani* is to receive the sonorous un-
; in such a manner as to be thrown into *reciprocal vibra-*
ch is to be communicated to the chain of bones. It cannot,
reciprocate any sounds that are lower than its own funda-
ote; hence, if it be unduly tense from any cause, the indi-
ill be deaf to low sounds. In its natural condition it is
*ıx* than tense; by this means it can reciprocate a greater
f sounds. The integrity of this membrane does not seem
ential to hearing, since it may be perforated, or destroyed,
the loss of the sense.

*ıain of bones* is intended to *conduct* the sonorous undulations
ıe tympanum to the internal ear. The *tensor tympani*
hich is inserted into the handle of the *malleus* has a pro-
gency over the organ of hearing, analogous to that of the
hen this muscle contracts it draws in the handle of the
and renders the membrana tympani tense, and thus takes
m it the power of reciprocating low sounds. It is also
of being excited to reflex action by *loud* sounds, and thus
the membrane into such a state of tension as not to recipro-
n. It may, therefore, be fairly compared to the iris, which
; ever the more powerfully the stronger the light that im-
pon it.

*mpanum* isolates the chain of bones and allows free vibra-
he membrane at either end of it. Moreover the air which it
reverberates, and the walls and neighbouring spaces and cells
norous pulses, which thus fall strengthened upon the walls
ıbyrinth, and particularly upon the membrane of the fene-
is and fenestra rotunda. The principal use of the Eustachian
ms to be, to maintain the equilibrium between the air of the
ım and the external air, so as to prevent undue tension of
ıbrana tympani. It also serves to conduct away the secre-
the middle ear, which it discharges into the cavity of the
y means of ciliæ vibrating upon its surface.

ard to the uses of the different parts of the labyrinth nothing
s known. The *semicircular* canals are supposed by their
to give information as to the *direction* of sounds. The
in like manner, is thought to enable us to judge of the pitch
an idea which seems to derive confirmation from the corre-
development of this portion in animals, and the variety in
of the sounds which it is important they should hear dis-
The *vestibule*, from its uniform presence, may be considered
ssential part of the organ of hearing.

hain of bones, it was said, connects the external
he base of the stapes is attached to the memb
stra ovalis. Immediately beneath this is a ci
ıe *foramen rotundum*, which also is filled u

brane, and is capable of receiving reciprocal vibrations from the air of the middle ear, and transmitting them to the internal ear.

The *vestibule* and *semicircular canals* have lying within them a *membranous labyrinth*, having the same general shape as the cavities in which it lies, only smaller. Between it and the walls of the bony labyrinth lies the fluid called the *perilymph*, and within it is contained the *endolymph*, and some small calcareous particles called *otolithes* or ear-stones. The use of the membranous labyrinth is probably to afford a more extended surface for the expansion of the auditory nerve. The *otolithes*, by being thrown into vibration, probably increase the impression upon the nerve.

The sonorous waves reach the labyrinth from the membrana tympani in three distinct ways. 1st. A portion of the vibrations reflected from the walls of the tympanum reaches the external wall of the vestibule immediately, this being at the same time the internal wall of the tympanum. 2d. Other vibrations are thrown directly upon the fenestra rotunda, and in this way reach the cochlea. 3d. A third set of vibrations travel along the chain of bones immediately from the membrana tympani to the labyrinth. This is the most powerful of any. The fluid of the labyrinth may also be thrown into vibration, by undulations transmitted through the bones of the head.

A single impulse communicated in any of the above ways is sufficient to excite the momentary sensation of *sound*, but a number of them in rapid succession is essential to the production of a *musical tone*. The *acuteness* or *depth* of the tone depends upon the rapidity with which the impulses succeed each other.

The acuteness of hearing varies very much in different individuals, and its power may be very much increased by practice. A part of this increase is due to the greater attention which its fainter indications receive; a part also to the increased use of the organ. A want of *musical ear* is an encephalic defect, and not a deficiency of the organ.

The power of appreciating the *direction* of sounds is for the most part acquired by habit. In some instances we are assisted by the relative intensity of the sensations communicated to the two ears respectively. The idea of *distance* is another acquired perception depending principally upon the *loudness* or *faintness* of the sound.

The sensation of sound often lasts longer than the exciting cause of it. It is upon this circumstance that the continuity of a musical tone depends; a fresh impulse succeeding before the impression of the first has disappeared.

The *subjective phenomena* of hearing generally result from some affection of the brain, or that part of it in which the auditory nerve is implanted. Ringing sounds, or buzzing in the ears, are the most common, and are indicative of either redundancy or deficiency

d in the brain. They may also be caused by some disturb-
the local nutrition of the brain.

## SENSE OF VISION.

he sense of sight, we become acquainted with the existence
'; and by the medium of that agent, we take cognizance of
n, size, colour, position, &c., of bodies that transmit or reflect
knowledge of the laws of light and optics, is essential to an
anding of the functions of the different parts of the organ of
for these the student is referred to the works on natural
phy.

e globe of the eye we recognise, as the most essential parts,
ansion of the optic nerve, called the *retina;* and in front of
*transparent refracting media*, which transmit the light so
ring it to a focus upon the nervous expansion. The optic
t its entrance into the eye splits up into numerous fibrils,
pread themselves out, and inosculate freely with each other,
form a net-like plexus. This plexus comes into relation
merous vessels and a layer of ganglionic cells, like those in
ical part of the brain. This layer of cells constitutes the
l layer of the true retina.

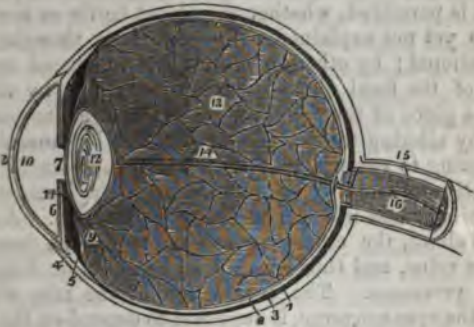
der to protect the retina, the slightest change in whose form
be attended with injury to its function, the whole is enve-
n a dense tissue called the *sclerotic*, which is opaque, with
eption of its front, where it becomes modified to allow the
o enter, and is called the *cornea*. Between the sclerotica
e retina is a layer of dark pigment contained in a delicate
ane called the *choroid*, the use of which is to absorb the rays
after they have made their impression upon the retina. In
ino it is entirely wanting, and in others it becomes gradually
in colour as they advance in life, so as to increase the sti-
applied to the retina, by reflecting the rays again from one
its surface to another. In front of the retina are the *trans-
media*. These are the *vitreous humour*, the *crystalline lens*,
*aqueous humour*. The *vitreous humour* lies immediately
the cup formed by the retina, and seems destined to give it
essary support inside, which the sclerotic gives outside. In
erior part of the vitreous humour is imbedded the *crystalline*
hich comes nearly up to the cornea in front, leaving a small
however, which contains the *aqueous humour*. Across this
and dividing it into an *anterior* and *posterior chamber*,
vertical curtain-like process of the choroid, cal
perforated in its centre by a circular apert
which is capable of being enlarged or dimini
rmitted by the fluidity of the aqueous hum

---

* Todd and Bowman.

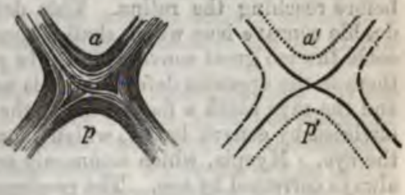
traction of the pupil under the stimulus of light, seems to be effected by a *sphincter muscle* surrounding the orifice of the pupil, and put in action by the third pair of nerves. This seems to be a pure reflex action, in which the optic nerve is the *afferent*, and the third pair the *efferent*. The stimulus is the presence of light. When the optic nerve is divided, the *fifth pair* may in some degree convey the requisite stimulus. The *dilatation* of the pupil probably results from the elasticity of the tissue of the iris after the muscular contraction has ceased. The iris prevents the ingress of too much light, and also shuts off the rays of light from falling on the circumference of the lens. The *transparent media* so refract and modify the rays of light, as to overcome both *spherical and chromatic aberration*, and bring them to a perfect focus upon the retina.

Fig. 37.*



The *second pair of nerves* is devoted to the sense of sight, and is ence called *optic*. The greater part of their roots may be traced the tubercula quadrige- ina, which are regarded the optic ganglia; from ese they run forwards ong the base of the brain, d unite in front of the ber cinereum and mamillary bodies, forming an timate junction called the *iasm*. From this point ey diverge, and enter the

Fig. 38.†



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Longitudinal section of the globe of the eye. 1. Sclerotic. 2. Cornea. 3. Choroid con ted anteriorly with (4) ciliary ligament; and (5) ciliary processes. 6. Iris. 7. Pupil. 8 ina. 9. Canal of Petit. 10. Anterior chamber, containing aqueous humour. 11. Poste- chamber. 12. Crystalline lens. 13. Vitreous humour. 14. Neurilemma of the optic re. 16. Central artery of retina.

Course of fibres in the chiasm. *a*. Anterior fibres, commissural between the two retinæ osterior fibres, commissural between the thalami. *a'*. *p'*. Diagram of the preceding.

through the optic foramina. Part of the fibres of each nerve
the opposite eye, part are commissural, and the remainder
the eye of the same side. (Fig. 38.)

eye has six muscles, four straight, the *recti;* and two
, the *obliqui*. The first are supplied by the third pair of
, except the rectus externus, which has the sixth. Of the
the superior oblique receives the fourth pair; the inferior, a
of the third. When the *recti* act together, they fix the
l; when singly, they turn it towards their respective sides.
*lique* antagonise the recti, and in addition, when acting toge-
raw the globe inwards, and converge the axes of the eye. The
r oblique turns the eye downwards and inwards, and the
r oblique upwards and inwards. There is, however, considera-
certainty as to their functions.

adaptation of the eye to distances, by which a perfectly dis-
nage is perceived, whether the object be far or near, is a phe-
on as yet not explained. By some it is thought to be en-
educational; by others it is supposed to depend upon a vary-
gth of the focal distances, produced either by altering the
of the globe of the eye, so as to diminish or increase its con-
or by altering the position of the lens by muscular agency.
teresting to remark, that the adjusting power of the eye is
greatly impaired by the extraction of the lens, or by para-
the ciliary and iridial muscles by belladonna. According to
ay Wallace, the ciliary muscle advances the lens, by com-
g the veins, and thus causing an erection, or lengthening of
liary processes. The contraction of the iris, which takes
hen the eyes converge, is supposed to depend on the third pair,
is distributed to it and the internal recti.

forms of imperfect vision, known as *myopia* and *presbyopia*,
be attributed entirely to defects in the optical adaptation of
. In *myopia*, or *near-sightedness*, the refractive power of
is too great, and the rays of light are brought to a focus
reaching the retina. This defect is to be corrected by a
concave lens which shall *disperse* the rays, and thus over-
he too great convergence. In *presbyopia*, or *far-sightedness*,
s the opposite defect, there is not sufficient refracting power,
e rays reach a focus behind the retina. This defect is to be
ed by convex lenses, which increase the refracting power of
. Myopia, which commonly occurs in young persons, is not
corrected by age. The presbyopic eye is always present after
eration for cataract.

known that the rays of light from the op e 1
ous object, by reason of the changes the ler
cessive refractions which they experience, c nes
e image on the retina appears invert

arises, how do we see objects *erect*, with an *inverted* image on the retina? Volkmann has shown, that Sir D. Brewster's law of visible direction, which affirmed that every object is seen in the direction of a perpendicular to that point of the retina on which the image is formed, and that as all these perpendiculars meet in the centre of the eye, the line of direction is identical with the prolonged radius of the sphere, is not optically correct. Some of these lines cross each other at a point behind, and some before the lens, and they thus fall on the retina at such different angles, that no general law can be laid down respecting them. The notion of erectness, which we form by the combined use of our eyes and hands, is really the result of intuitive perception.

*Single vision with two eyes,* is explained by the fact that the rays of light proceeding from a luminous object fall upon parts of the retina which are *accustomed to act together*. It is not necessary that these points should be equidistant from the optic nerve, as is evident in strabismus. Double vision almost always follows the operation for its cure, till the parts become accustomed to act together.

The vanishing of images that fall on particular parts of the retina, as shown in Marriotte's experiments, is due to the fact that the rays fall directly upon the centre of the optic nerve, at the point where the middle artery of the retina passes in; and as this has no special sensibility, no impression, of course, is conveyed to the brain.

By the association of visual and tactual sensations, we obtain knowledge of various properties of bodies, such as smoothness and roughness, form, and to a certain extent, of distance. In the latter both eyes seem to be required. The distinctness of outline also assists us in the estimate of distances, haziness of outline being generally associated with distance. If we know the *real* size of an object, we often judge of its distance by its *apparent* size.

Impressions made upon the retina continue for some time after the removal of the stimulus. It is this which causes the appearance of *a circle* of light when an ignited point is rapidly moved in a circle. It also accounts for the optical delusion in the toy known as the thaumatrope.

The phenomena of *accidental colours* is thus explained. When the eye is steadily fixed for a length of time upon one particular colour, as for instance, upon a red wafer, the retina becomes fatigued, and loses its impressibility to that colour; if now the eye be turned to a white ground, a spot having a different colour will be seen; this will be made up of all the colours of the solar spectrum, *minus the red*, and the resulting one colour is called the *complementary* or *accidental colour*. In this case it will be bluish-green. The laws of harmonious colouring in painting, are founded upon the combination of complementary colours.

e subjective phenomena of vision are familiar to all. Examples en in the flashes of light before the eyes in congestion of the ; and that also result from blows that jar the optic nerve or ia.

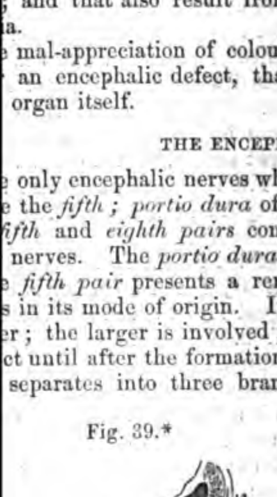
e mal-appreciation of colours, like the deficient musical ear, is an encephalic defect, than in any way connected with the organ itself.

## THE ENCEPHALIC NERVES.

e only encephalic nerves whose functions have not been alluded e the *fifth*; *portio dura* of the *seventh*; and the *eighth pairs*. *ifth* and *eighth pairs* combine the functions of *sensitive* and nerves. The *portio dura* is entirely *motor*.

e *fifth pair* presents a remarkable resemblance to the spinal s in its mode of origin. It arises by two roots, a larger and a er; the larger is involved in a ganglion, and the two are quite ct until after the formation of the ganglion. The trunk of the separates into three branches, the *ophthalmic*, the *superior maxillary*, and the *inferor maxillary*. The first two consist exclusively of fibres derived from the posterior, or larger root and ganglion; the third is composed of fibres from both roots; it is the only portion that is strictly compound (Fig. 39).

Fig. 39.*



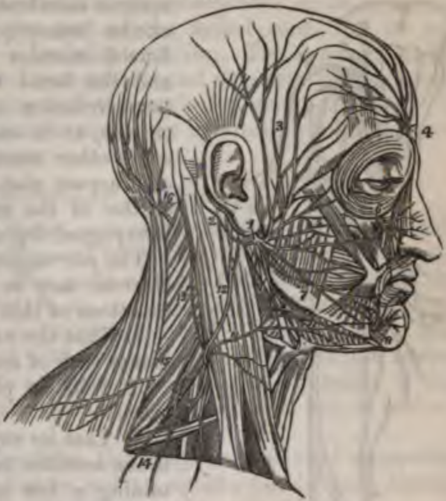
The ophthalmic and superior maxillary being composed of fibres from the posterior root, are exclusively *sensitive*. The inferior maxillary is both *motor* and *sensitive*. The ophthalmic and superior maxillary are distributed entirely to sentient surfaces; division of them, therefore, destroys the sensibility of those parts, without impairing the muscular action. The inferior maxillary sends some branches and motor filaments to the muscles of mastication; the s go to the integuments of the lower part of the face, and the us membrane of the mouth and tongue, which they supply

---

iew of the distribution of the fifth pair. 6. First branch of the fifth pair or ophthal- . Second branch or superior maxillary. 8. Third branch or inferior branch. For ference, see Anatomy.

with general sensibility. Division of these last destroys the general sensibility in the parts to which they are distributed, and also puts a stop to the movements of mastication. Painful affections of the face (neuralgia) have their seat in the sensitive branches of this nerve.

Fig. 40.*



The *portio dura* of the seventh pair is the *general motor* nerve to the face, (Fig. 40.) The muscles supplied by it are chiefly those upon which the aspect of the countenance and the balance of the features depend. It is sometimes called the *nerve of expression.* The acts of closing the eyelids and frowning depend on this nerve. Subsequently to its entrance into the canal from which it emerges, it receives sensory filaments from the fifth, and some cervical nerves, which cause irritation of its several branches to produce pain. Section of the nerve, at its point of emergence from the stylo-mastoid foramen, is followed by paralysis of the muscles of the face and eyelids.

It was formerly thought to be the seat of *neuralgia*, and was upon several occasions cut. The only result was *paralysis of that side of the face, total loss of control over the features, of the power of frowning, and of closing the eyelids.* The portio dura is also the channel of the reflex movements concerned in respiration, but it is not at all concerned in mastication.

The *eighth pair of nerves* is made up of three others, the *glosso-pharyngeal*, the *par vagum* or *pneumogastric*, and the *spinal accessory* (Fig. 41). The conclusions that have been arrived at by physiologists in relation to these nerves, can alone be stated here.

The *glosso-pharyngeal* is the *sensitive nerve* of the mucous membrane of the fauces and of the root of the tongue, and in the latter situation it ministers to taste and touch, as well as to common sensibility; and being the sensitive nerve of the fauces, it is probably ed in the feeling of nausea so readily excited by stimulating cous membrane of this region. Such are its peripheral organization, and central connexions, that stimulation of any part of the mucous membrane in which it ramifies, excites instantly to contraction all the faucial muscles supplied by the vagus and the facial nerves, and the permanent irritation of its peripheral ramifications, as in cases of sore throat, will affect other muscles supplied by the facial nerves also. It is, therefore, an *excitor* of the movements necessary to pharyngeal deglutition.

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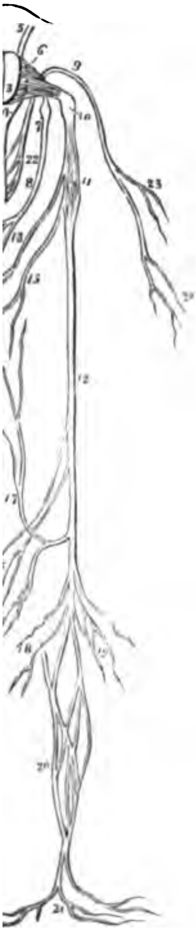
* Distribution of the facial nerve. 1. Facial nerve escaping from stylo-mastoid foramen. For references, see Anatomy.

Fig. 41.*



The *par vagum.*—The following conclusions may be adopted respecting the functions of this nerve and its branches.

1. That the vagus nerve contains filaments both of *sensation* and *motion.*

2. That its pharyngeal branches are *motor.*

3. That its superior laryngeal branch is the *sensitive* nerve of the larynx, containing a few motor filaments to the crico-thyroid muscle.

4. That the inferior laryngeal is the principal *motor* nerve of the larynx.

5. That the cardiac branches exert a slight influence on the movements of the heart.

6. That its pulmonary branches contain both *motor* and *sensitive* filaments, and exercise an important influence upon the respiratory acts, for they cannot be destroyed without retarding materially the respiration, impeding the passage of the blood through the lungs, and causing œdema of these organs.

7. That the œsophageal branches are the channel through which the muscles of that tube are excited, through the medulla oblongata, to contract.

at the gastric branches influence the movements of

---

and distribution of eighth pair of nerves. 6. Origin of the glos-
Trunk of the nerve. 9. Spinal accessory. 10. Ganglion of the
of the spinal accessory.

stomach, and probably in some degree the secretions and the sensibility of its mucous membrane; but that their integrity is by no means essential to the continuance of the secretion, or to complete chymification. (Todd and Bowman.)

The *spinal accessory* is so called in consequence of its extensive connexion with the upper part of the spinal cord. Of its two branches, the *internal* is probably *sensitive*. The *external* is distributed to the *sterno-cleido-mastoideus* and *trapezius* muscles, some of its filaments inosculating with the cervical plexus, and is *motor* in its functions. The movements excited by irritating it are of a direct, and not of a reflex character.

## MUSCULAR MOTION.

The muscular system forms part of the apparatus of animal life, inasmuch as it is the instrument by which nervous energy operates upon external objects. The contractility which it manifests on the application of a stimulus, is an endowment derived from its own structure, and not from the nervous system. The presence of this contractility is connected with the healthy nutrition of the tissue, and with its due supply of arterial blood: the separation of any muscular part from its nervous connexions has none but an indirect influence on its properties.

The development of muscles, their physical and vital properties, their mechanical adaptation as moving agents, having been already described (pages 38, 39), but little remains to be added.

There is one form of *contractility* which produces a *constant* tendency to contraction in the muscular fibre, but which differs from simple elasticity from the fact that it exists after death and before decomposition takes place. This is called *tonicity*, and it manifests itself in the separation or retraction that takes place between the divided ends of a living muscle, as in amputation. It also shows itself in the permanent flexure of the joints when the extensors are paralysed, as in lead palsy. In the healthy state the tonicity of the several groups of muscles is counterpoised, but the balance is destroyed when the tonicity of one set is lost or impaired.

The tonicity is greater in the non-striated than in the striated; it is this property that keeps the walls of the arteries contracted upon their contents. It is increased by cold, and diminished by heat. The *rigor mortis*, as already described, is probably to be regarded as a manifestation of this property.

The *energy* of muscular contractions is seen in the various feats of strength performed by jugglers, &c. It is very much increased by continued exercise. Much, however, depends upon the mechanically advantageous application of the power; persons of ordinary strength may in this way perform feats that would seem incredible.

An idea of the *rapidity* of muscular contractions may be had by ing the number of letters that can be pronounced in a given Some persons can pronounce 1500 in a minute; each of equires a separate contraction of muscular fibres, followed by ation of equal length. Each contraction must therefore have d in one-tenth of a second.

production of *Voice*, or vocal sounds, depends upon the appli- of muscular power to the vocal instrument, and is therefore y considered under this head.

## OF THE VOICE AND SPEECH.

voice is produced when the air is expelled from the lungs; ne knows it is impossible to articulate sounds with the mouth se closed. It must be remembered that vocal sounds and are two very different things; the former may be produced t perfection, where there is no capability for the latter. The s formed in the larynx; the modifications of it by which is formed, are effected in the cavity of the mouth. The voice, or *cry*, exists in nearly all animals. Man alone, it is d, has the power of producing articulate sounds or *language*. larynx consists of four cartilages. The *cricoid*, the *thyroid*, o *arytenoid*. The *cricoid* is the lowest of these; it surmounts chea, and is shaped like a seal-ring, having its deepest portion . The thyroid is situated above the cricoid, with which it is ited by its lower cornua, in such a manner that its lower front may be made to approach or recede from the upper margin cricoid. The higher the tone, the more nearly do they ap- ate. The *arytenoid* cartilages are situated upon the posterior perior portion of the cricoid, with which they are articulated a moveable manner. From the tips of the arytenoid carti- o the inner front of the thyroid, are stretched the two pairs l ligaments, composed of yellow elastic tissue, and named the *r and inferior vocal ligaments.* The whole inferior surface larynx is lined by mucous membrane, which is reflected over al cords, dipping down into the spaces between them to form *tricles of the larynx*, or, as they are sometimes called, the ven- of Morgagni, or of Galen (Fig. 42). Upon the varying degree ion of the vocal ligaments depends the variety of tones of the voice is susceptible. For the production of vocal tones aments of the opposite sides are also required to be brought proaching parallelism with each other, by the approximation points of the arytenoid cartilages, whilst in the intervals they arated from each other, and the *rima glottidis*, o them, assumes the form of the letter V (Fig. 43 muscles that are concerned in governing the by regulating the tension of the cords, and th the aperture of the glottis, are the following. (The table is modified from Carpenter's Human Physiology.)

Fig. 42.*

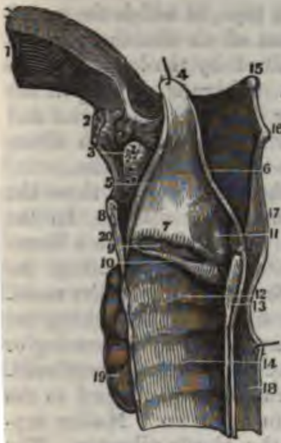
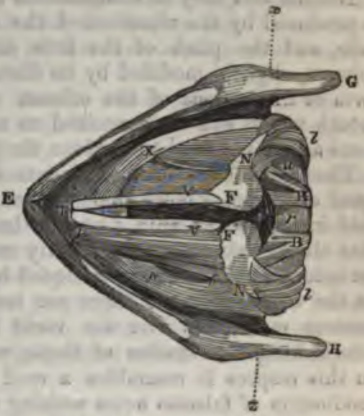


Fig. 43.†



GOVERN THE PITCH OF THE VOICE.

| | |
|---|---|
| *Crico-thyroidei,*<br>*Sterno-thyroidei,* | Depress the front of the thyroid cartilage on the cricoid, and *stretch* the vocal ligaments; assisted by the arytenoideus and crico-arytenoidei postici. |
| *Thyro-arytenoidei,*<br>*Thyro-hyoidei,* | Elevate the front of the thyroid cartilage, and draw it towards the arytenoid, *relaxing* the vocal ligaments. |

GOVERN THE APERTURE OF THE GLOTTIS.

| | |
|---|---|
| *Crico-arytenoidei postici,*<br>*Arytenoideus,* | *Close* the glottis. |
| *Crico-arytenodei laterales,* | *Open* the glottis. |

The muscles that relax or stretch the vocal ligaments are con-
rned in voice alone. Those that govern the aperture of the glottis
e also concerned in respiration, regulating the amount of air re-
ived. They are also the seat of the spasmodic affections of the
rynx which so often occur in children.

The vocal apparatus has been compared to various instruments,
ch as *stringed instruments*, *flutes*, and *reed instruments*. It is not
stly compared to a stringed instrument, inasmuch as the cords are

---

Vertical section of the larynx to show its internal surface. 7. Superior vocal ligaments.
ection of thyroid cartilage. 9. Ventricle of Galen. 10. Lower vocal ligament. 11. Ary-
oid cartilages. 12. Inside of cricoid cartilage.

Larynx from above. G. E. H. Thyroid cartilage. N. F. Arytenoid cartilages T. V. T. V.
al ligaments. N. X. Crico-arytenoideus lateralis. V. *k*. *f*. Right thyro-arytenoideus.
. N. *l*. Crico-arytenoidei postici. B. B. Crico-arytenoid ligaments.

t to produce all the varied notes of which the human voice
le, more especially the lower notes. Besides which they are
with mucous membrane, which would act effectually as a
upon them.

er can they be compared to a flute pipe, in which the sound
.ced by the vibration of the column of air contained in the
d the pitch of the note determined by the length of the
slightly modified by its diameter. There is nothing in the
dimensions of the column of air between the larynx and
vhich can be conceived to render it capable of such vibra-
are required to produce the tones of the human voice.

third class of instruments are the *reeds*, and to these the
gan bears more analogy than to any of the others. In the
trument, a thin plate or lamina vibrates freely in a frame
ws the air to pass readily round it. In the accordion the
as in the tone are produced by different lengths in the reeds.
ocal apparatus there are laminæ formed by stretching the
membrane over the vocal ligaments, and by increasing or
ing the tension of these, various notes can be produced.
respect it resembles a reed instrument. In regard to the
ion of falsetto notes nothing certain is known. Muller sup-
.at in them merely the border of the glottis vibrates. The
MM. Diday and Petrequin, that in the production of fal-
tes, the vocal cords are not thrown into vibration, but are
d tightened, so as to resemble the "mouth orifice" in the
hile the column of air is thrown into vibration, as in that
ent, appears most reasonable.

*intensity* of the voice, or, as it is commonly called, the
of the voice, results in part from the force with which the
iven from the lungs, and from the size of the thoracic cavity;
art from the facility with which the vocal cords and other
the larynx are able to vibrate. These modifications explain
erence which exists between the male and female voices.
al cords in the male are longer than in the female in the
on of 3 : 2, and their voices are commonly an octave lower.

power of the will in determining the exact degree of tension
y to produce a given note, is extremely remarkable. The
compass of the voice in most persons is two octaves or 24
es. Now a singer can produce ten distinct intervals between
mitone, or 240 intervals. There must, therefore, be 240
t states of tension of the vocal cords all producible at
when a distinct conception exists as to the tone req
these different notes can be produced witho
n in the length of the vocal cords than one-fift
peculiar *timbre*, or *quality* of the voice which
s, and its imperfections, depend on the smoothn

A

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# SURGERY.

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## INFLAMMATION.

THE definitions of inflammation vary with different authors. That of Miller is as satisfactory as any other. He defines inflammation to be "a perverted condition of the blood and blood-vessels of a part interrupting its healthful function, and changing its normal structure; ordinarily attended with redness, pain, heat, and swelling; and inducing more or less disturbance of the general system." The term should be limited to processes *essentially morbid*.

The transition from health to inflammation may be divided into three stages: 1. Simple vascular excitement; 2. Active congestion; 3. True inflammation.

1. *Simple Vascular Excitement.*—When any irritant is applied to the skin, an impression is produced through the nervous system which is manifested particularly in the blood-vessels.

At first the blood circulates with great rapidity, although the small arteries and capillaries are of diminished calibre. Afterwards he vessels yield and are dilated, and an increased quantity of blood irculated with great rapidity, with a tendency to serous and plastic xudation. The function of the part is exalted, and this may be manifested by excessive nutrition or secretion. This is simple vas-ular excitement.

2. *Active Congestion.*—More blood is sent to the part, and the pillaries and minute arteries begin to give way under the increased lsation of larger arterial trunks; by over-distension, the vascular ats lose their tonicity. "And partly from this cause, partly on ccount of change in the blood itself, which seems more viscid, with corpuscles less distinct, and, when examined by the microscope, found especially to possess an increased number of colourless ymph globules,' unusually adhesive to each other, and to the walls the vessel, and so manifestly operating obstructively—and partly, o, it is probable, from an increase of vital attraction between the ood and surrounding parenchyma—the circulation loses its acquired pidity, and becomes slower even than in health. The red corpus-

no longer limited to the central current, but are encroaching nd more on the lateral and clear 'lymph spaces.' Exudamore copious than in the previous stage; it consists of serum liquor sanguinis, the latter usually predominating: and when on has been for some time sustained, and as it were, estain the part, fibrin alone may be deposited." "The natural ı of the part is not simply exalted, but begins to be perverted, mple, secretion is not only increased, but changed in its cha-' Nutrition is becoming more and more disturbed,—this is mencement of diseased action. "This action may resolve ıe removal of its simple exciting cause; or it may be susfor some time, as in the healing of wounds, and the closing ·s; or it may advance to

*True Inflammation*.—The change which, in the preceding ıad begun in the blood, is now completed. The over-distenthe capillaries is established; the capillary power is for a ne, perhaps in consequence of diminution or actual suspenthe nervous influence; and the coats of the capillaries and essels are thickened, softened, and impaired in cohesion, being lves the subjects of structural change. The languor of cir-ı approaches stagnation, and at some points this has actually d; every part of the distended capillaries is occupied by d coloured and colourless corpuscles; partly, it may be, ıcreased attraction between the former and the surrounding ıyma, partly by accumulation and adhesion of the latter to her and to the capillary walls. The altered liquor sanguinis led in profusion. The capillaries also give way in their nd from the lesion, blood is extravasated in mass. Suppurain progress by extravascular degeneration of the fibrinous ı, or else by a secretive elaboration of it ere yet it has left sel. Breaking up and disintegration of texture ensue, ac-; to the extent of extravasation and suppuration; and the grated texture is commingled with the effusion. The forma-wer has ceased, and the opposite condition, a tendency to gration, from diminution of vitality, has become established. ɘr of function is complete; secretion, for example, being in st place arrested, and when restored, more vitiated than "

*local symptoms* are redness, swelling, heat, pain, throbbing, ed sensibility, disorder of function, arrest and change of se-

*ness*.—This is due to an afflux of blood to the p come distended, and the capillaries convey re tion of the red globules is also increased by the um. The *degree* varies in different tissues, and ensity of the action; compare, for instance, an in with an inflamed mucous membrane. The *tint* varies also between a bright scarlet and a deep purple. *Permanency* is characteristic of inflammatory redness. The redness of blushing is not indicative of inflammation, because it is momentary, and not conjoined with other symptoms.

*Swelling.*—This is occasioned by the increased quantity of blood, and an effusion of serum, pus, &c. The swelling of inflammation must be conjoined with other symptoms also, for in œdema there is swelling, but not inflammation. It must be *gradual* in its development: the sudden swelling produced by a hernia or dislocation is not that of inflammation. It must also be recent, not like the tedious growth of a genuine tumour. Swelling may be injurious, as in the brain or orbit of the eye; or it may be useful, as in a fracture, &c. It is most remarkable in loose textures; also in the breast, testicles, and lymphatic glands.

*Heat.*—This depends upon a more rapid oxidation of the tissues, which are also supplied with an increased quantity of blood. Heat of inflammation may be partly actual, as ascertained by the touch or the thermometer, and partly the result of a perverted nervous function, estimated only by the patient. It must be permanent, and conjoined with other symptoms to be characteristic, for in hectic there is burning of the hands and feet, yet no inflammation is there.

*Pain.*—Is caused partly by the pressure upon the nerves of the inflamed spot, and the distension of the arteries which are supplied by small nerves; and partly by disordered function. Mechanical pressure increases it, for instance, by the hand in peritonitis, or inspiration in pleurisy. Pain varies with the natural sensibility of the part affected, hence inflammation of the skin is more painful than that of cellular tissue. It is proportionate to the yielding nature of the structure affected; thus inflammation produces more pain in bones and ligaments, than in mucous membrane.

Pain is not always indicative of inflammation—for example, in pasm and neuralgia. In spasm the pain comes on suddenly, and s relieved by pressure; in neuralgia it is intermittent. Not so with nflammation—in the latter the pain gradually increases from the rst; if it suddenly disappears suspicion is excited lest gangrene as supervened. Pain may be sympathetic, and referred to a part t a distance: in coxalgia, the pain is at the knee; in liver disease, t the shoulder; in disease of the kidney, at the orifice of the ure-ura. This is a point of practical importance in the application of emedies.

*Increased sensibility.*—This may be illustrated by intolerance of ght when the eye is inflamed; the tenderness of the skin in erysi-las; the rejection of food by the stomach, and the constant urina-n if the bladder is the seat of inflammation.

*rder of function.*—The stomach cannot digest, nor the kidney
. If the brain or spinal cord be the seat, we may expect con-
ıs, or paralysis.

*causes of inflammation* may be divided into *predisposing* and
*g.*

*lisposing causes.*—Include sanguine temperament, excitabi-
lethora, excess in food, drink, or exercise; debility, mias-
bad air, food, and clothing; previous disease, &c. These may
sidered as constitutional or idiopathic.

*iting causes.*—May be *direct*, such as the chemical effects of
ıalts, &c.; or mechanical effects of wounds, pressure, &c. *In-*
or vital, such as heat and cold, cantharides and turpentine.
*'c,* as in the instance of vaccine virus.

*duration* and *character* of inflammation are modified by the
, situation, and condition of the part affected, and the tempe-
; and diathesis of the patient. Age, sex, habit, atmosphere,
ason, all exercise an important influence in its progress and

### RESULTS OF INFLAMMATION.

*Resolution.*—This is the most favourable result. It is the re-
on of the part, as regards both structure and function, to its
l and normal state. Effusion takes place, the vessels are
d, the red globules move on, absorption takes place, and the
ymptoms subside. *Delitescence* is the *sudden* disappearance
mmation; and when it is attended by the establishment of a
ıe, the term *metastasis* is used.

*Excessive deposit.*—Either of serum or fibrin, which has ex-
hrough the coats of the vessels. When *serum* is effused into
r tissue it constitutes *œdema*, which is characterized by *pitting*
ssure; when effused and collected in serous membranes, it
utes *dropsy.* The effusion of fibrin requires a higher degree
ımmation, upon the subsidence of which new structures are
. by the organization of the fibrin, and parts are repaired;
the term plastic is applied to it. Thus, wounds unite, bones
nd arteries consolidate.

*Hemorrhage.*—Occasioned by the destruction of the coats of
ssels. If it occur in the interior, it is termed extravasation.
ısually injurious, by producing pressure and exciting irrita-
s, for instance, in the humours of the eye, or membranes of
ıin.

*Suppuration.*—The formation of a fluid called
*laudable* when it is yellow, creamy, and opaque:
but readily mixing with it. It has no odo
ıh taste. It is not corrosive, but bland
granulations until covered by cuticle.

produces disintegration of the textures in contact, by pressure. It is the result of a vital action. It consists of a fluid and globules. The fluid is the liquor sauguinis of blood effused; this separates into serum and fibrin; the fibrin becomes granular by the formation of exudation corpuscles, and these degenerate into pus-globules. When pus is thin and acrid it is termed *ichor*, consisting mostly of serum. In scrofulous persons it is flaky. When it contains blood it is called *sanies*. When it is of a leaden colour, thick, coagulated, and very offensive, it is *sordes*. Sometimes it is mixed with a subtle virus, as the venereal or vaccine; it is then said to be *specific*. When mixed in the mucous or serous discharges, it is termed sero-purulent or muco-purulent.

When suppuration is profuse and long continued, in a debilitated frame, it produces a fever called *hectic*, which is a constitutional irritation different from the inflammatory type. It is remittent, and attended with paleness of surface, except upon the cheeks. The appetite is good, but yet there is great emaciation. The tongue is clean, at first moist, but afterwards dry and glazed or aphthous. The bowels are constipated, or else attended with a diarrhœa, termed colliquative. The palms and soles burn, and there is great thirst. Respiration is rapid and short. The pulse is frequent and small. At noon there is increased fever preceded by a chill; at night there is perspiration, most profuse towards morning. The eyes are bright, though sunk in hollow orbits; and though there may be sleeplessness, lassitude, and debility, yet the mind is clear and the spirits are good.

5. *Ulceration.*—Hunter supposed that it was entirely the result of absorption. It is more properly a vital softening of a texture hanged by inflammation and suppuration; becoming disintegrated nd fluid, it passes away with the pus. The more violent the inflammation, the more rapid is the destruction; the term phagedenic is pplied to those ulcerations in which the part is apparently eaten or onsumed with unusual rapidity. Congestion is a predisposing ause of ulceration. The skin, mucous membranes, and cellular issue, yield more rapidly in ulceration than the vascular, nervous, nd fibrous tissues. Those of intemperate habits, and of scrofulous r syphilitic taint, are most liable to its ravages. The parts most kely to be affected are those whose circulation is weak and languid, ich as the lower extremities, and parts newly formed, such as cicaices, callus, and tumours.

6. *Mortification.*—This term includes the dying and death of a rt from injury or disease. *Gangrene* denotes the process of ying, and is recognised by the following signs. Redness is changed to a livid hue; circulation is arrested, so is effusion, and there is s tension. Pain and heat abate, often suddenly. Putrescence mmences, and there is an offensive smell. Phlyctenæ, or vesicles

with putrid serum, appear over the skin. *Sphacelus* is the letion of the gangrene. The part is cold and insensible; ken, soft, and flaccid; crepitates distinctly, owing to its con- g gas, the result of putresence; vital action has ceased, and olour becomes black if the parts are exposed to the air. A *h* is a small sphacelation. Nature makes an effort to throw off jurious mass. The living part in contact with the dead in- s; and, in consequence, the abrupt livid line is bordered by a e, red, and painful swelling—the *line of demarcation;* this tes, the vesicle bursts, puriform matter is discharged, and an ned and ulcerating surface is disclosed—the *line of separation.* urrow deepens; skin and cellular tissue yielding first, the ten- and arteries resisting for some time. No hemorrhage occurs g gradual division of the parts; the arteries are sealed by the on of fibrin during the inflammation. But when the mortifica- s rapid, as in acute hospital gangrene, arteries are found playing dark and putrid mass alive, whilst all is dead around them. ngth they yield, and death is hurried on by hæmorrhage.

e *constitutional symptoms* are of a typhoid form. The pulse is ent and small, irregular or intermittent. The countenance is us, the face livid, the nose pinched, and the lips contracted.

xiety is soon changed into stupidity of expression, as if the nt were under the influence of opium or alcohol; sighing, hic- and involuntary movements of the hands and fingers are now ved, such as picking and fumbling with the bedclothes. Appe- ils; the tongue is coated with a brown fur, except at the tip dges. The lips and mouth are dry and incrusted; swallowing icult. The mind is stupid, wavering, and subject to illusions; rticulation is thick and broken. Still more marked are the like coldness, the clammy sweat, the small, indistinct, and ring pulse, and the cadaverous expression. In this state a nt will sometimes lie for hours, and die without a struggle.

rtification may be *acute* or *chronic*. The acute comprehends umid, inflammatory, and traumatic. The chronic—the dry diopathic.

e *cause* of mortification is a *want of vital power*, and may be sult of high inflammation, mechanical injury, pressure, heat, action to the return of venous blood, deprivation of nervous y, interruption to arterial supply, as by aneurism or tourniquet, general debility, bed-sores, improper food, spurred rye.

### TREATMENT OF INFLAMMATION.

e first object is always to remove the cause, and afterwards to nt or diminish the inflammatory action. The chief means are d antiphlogistic, and consist of

*neral Bloodletting.*—This is only required when the inflammation is severe, as in erysipelas and compound fractures, when important organs are involved, such as the lungs, bladder, kidney, eye, and peritoneum. If resorted to unnecessarily, it produces congestions, effusions, and atrophy. *Syncope*, or fainting, is produced when bleeding is pursued to a great extent. It is occasioned by the removal of the natural stimulus of the heart—the blood, and by the sedative influence transmitted from the brain, when deprived of its share of arterial blood. The benefit to be derived from bleeding is not merely the loss of superabundant blood, but also the sedative influence, whereby the emptied capillaries can resume their natural tone. A rapid full stream from a large orifice will soon produce syncope, if the patient be sitting or standing; whereas the system may be almost drained of blood by a slow stream from a small aperture, before faintness ensues, if the recumbent position is maintained. Bleeding is not to be regulated by its *amount*, but by its *effects*. As a general rule, the blood should flow until there is some paleness of the lips, sighing, nausea, fluttering of the pulse, or relief of pain. The ability to bear bleeding will vary according to age, sex, temperament, and disease. A man in health will faint usually from the loss of fifteen ounces; the same person, with a severe inflammation, particularly of the head, will bear double that amount. *Reaction* takes place after bleeding, the pulse rises, and pain increases, often to such an extent, as to require a second amount to be taken. A smaller quantity will now produce the same effects as a large one in the first instance. The operation is usually performed at the bend of the arm, in the neck, or in the anterior temporal artery.

*Local Bleeding.*—This is preferable when the inflammatory action is not high; when the powers of the system are low, when the inflammatory action on the part has been fully established, and there would be no benefit from a general bleeding, and when extreme age orbids it.

*Cupping.*—By this means blood is obtained more rapidly than y leeches, and we have the advantage of general bleeding comined with local abstraction.

*Leeching.*—Leeches can be applied where cups cannot. In order apply them, the part should be first washed, and if they will not tick, a little cream or blood should be smeared on it. Their appete is increased by being dry. If slow to bite, immersion in warm orter will be useful. Their bites are sometimes troublesome from emorrhage. This is arrested by the mur. tinct. ferri, or a fine oint of nitrate of silver. American leeches will draw a ʒ or ʒiss blood; foreign leeches take an ℥ or ℥iss. Salt will occasion them drop off.

*Purgatives.*—They deplete, by causing an increase of mucous halation from the bowels. They also act as derivant, prevent similation of nutrition, and promote absorption; they are particuseful in diseases of the head, but are contra-indicated in bad es, and inflammatory affections of the bowels.

*etics, diaphoretics,* and *diuretics* are useful at the outset, ing the stomach, and promoting perspiration, particularly t. ant. et potassæ.

*cury.*—Not only as a purge, but gradually introduced into the , it seems to exert a tonic effect on both the extreme blood- and the lymphatics; that is, in the absorbents, thus prevent- limiting impending effusion, and at the same time expediting noval of that which had already been exuded.

*um.*—Particularly useful when combined with calomel, and after bleeding. Before bleeding it arrests secretion, and stimu- -afterwards it soothes the nervous system, relieves pain, and ts reaction.

rict *diet* must be maintained, and the drink should be refri- ; at the same time both body and mind should be at rest, and hould be a good supply of fresh air.

*al Remedies.*—Complete *rest* of the inflamed part. Elevated *n,* so as to favour the return of blood. *Cold applications,* er, solution of sugar of lead, and muriate of ammonia— lly in the early stages; for in high inflammations *warmth oisture* are very grateful to some persons—relaxing tension, ssuaging pain. *Nitrate of silver* has great antiphlogistic , as well as caustic properties, especially when applied to the nd mucous membranes. Iodine also exerts a somewhat similar ce.

*nter-irritation.*—By means of dry cupping, blisters, setons, caustic, and actual cautery.

## ABSCESS.

abscess is a collection of pus in a natural or preternatural and may be either acute or chronic.

### ACUTE ABSCESS.

requently called *phlegmon,* when occurring in the subcu- s cellular tissue. Commencing with all the symptoms of nation,—fever, pain, redness, and swelling. The centre is vith œdema surrounding it. The formation of pus is indi- by rigors, an abatement of the fever, and a feeling of weight, , and throbbing. The centre softens, which is termed *ng,* and *fluctuation* can be felt. There is a natural tendency discharge of pus, which is more apt to be towards the skin. ess apt to open into serous than into mucous membranes. The having been discharged, the pyogenic membrane lining the becomes covered with numerous small, red, vascular emi- , called *granulations.* They are formed by the organization nph.

The cavity contracts and fills up with granulations. A white pellicle extends from the circumference, gradually covers the whole surface, and becomes organized into a new cutis and cuticle, called a *cicatrix*. At first the cicatrix is thin, red, and less vascular; it afterwards contracts and becomes paler.

The causes of abscess are mostly idiopathic; it occurs frequently after fevers; it may, however, be caused by blows, foreign bodies, &c.

*Treatment.*—The indications are, in the first stage to produce resolution, and prevent the formation of matter. After it has formed, the indications are to cause its evacuation, and induce granulation and cicatrization. There should be cold applications, and leeches applied to the part, purging, and low diet. When matter is formed, the applications should be warm fomentations and poultices. Poultices may be made of bread, Indian meal, or ground flaxseed softened with water; they should be large and light, and renewed frequently; they relax the skin, promote perspiration, soothe the pain, encourage the formation of pus, and hasten its progress to the surface. Lint soaked in warm water may answer for a substitute.

Abscesses need not be *opened* if they point, and are pyramidal, and do not enlarge in circumference, but may be allowed to burst themselves. But they should be opened when they are beneath tendons, fascia, or the thick cuticle; when caused by the infiltration of urine; when in loose cellular tissue, with a tendency to burrow; when near joint, or under the deep fascia of the neck,—where it is desirable o obviate the scar made by the abscess opening spontaneously. The est instrument for the purpose is a straight-pointed, double-edged istoury, by which the opening can be enlarged to any extent. The natter should not be forcibly squeezed out, but allowed to exude radually into a poultice. By introducing a tent the edges are revented from uniting.

Abscesses are sometimes absorbed, especially those in glandular tructures and venereal cases. This can be promoted by leeches, ercurial ointment, and remedies adapted to increase the general ealth.

### CHRONIC ABSCESS.

Is the result of a low degree of inflammation, and is often unsusected. It is lined by a cyst, and the pus is serous or curdy. Somemes the matter is concrete. Is most apt to occur in weak and rofulous habits, and is usually free from pain, redness, swelling, c. It may, however, become exceedingly large, and from distenon, inflame, ulcerate, and discharge.

*Treatment.*—Improve the general health, and promote absorption means of mercurial plasters, blisters, and iodine frictions. If it nnot be absorbed, it must be opened with care; a small, superial abscess should be opened freely at once, the cavity injected

stimulating solution, and pressure applied by means of com-
and bandage. If the matter is not freely evacuated, great in-
esults from the effect of air on the contained pus; putrefying,
oduct—hydrosulphate of ammonia is absorbed, and the patient
es typhoid. When the abscess is large, the opening should
all and valvular, so as to prevent the introduction of air; or,
ening may be healed after a portion of the matter has escaped,
nother made ten days afterwards; or, the part may be kept
ntly immersed in water.

## ULCERS.

ers are breaches of continuity of surface, the destruction
caused by disease or unrepaired injury. The following classi-
n will be found to include the great majority of ulcers.

### SIMPLE OR HEALTHY ULCER.

this we have an exemplification of granulation and cicatriza-
The surface is covered with a thick, creamy, yellow pus, not
ofuse, and inodorous. The granulations are small, pointed,
sensitive, and vascular. When they reach the level of the
cicatrization commences. The edge swells a little, and then
ered with a white pellicle of lymph, which is converted into
e.

*atment.*—The plan of the treatment is simply protective. Pus
natural protection to these granulations; if, however, it col-
it becomes a source of injury, increasing ulceration. The air
s a stimulus, and may cause too great inflammation. Hence
opriety of dressing. It should be lint dipped in tepid water
me simple cerate; water dressings are now preferred. The
ng should only be removed for the sake of cleanliness and re-
ig the fluid pus; but care should be taken not to wash the
e too freely, else the progress of cicatrization is delayed by
moval of lymph which may be mistaken for pus.

### WEAK ULCER.

the granulations are too luxuriant, becoming pale and flabby
ng, they should be treated by an astringent wash, such as a
on of sulphate of zinc or copper; or they may require an
otic, such as solid sulphate of copper or nitrate of silver; or
may be formed by exposure to the air, or spreading fine lint
the surface; at the same time a generous diet will be bene-

### SCROFULOUS ULCERS.

ese occur in debilitated constitutions, and usually in clusters;
frequently upon the neck and joints. They originate in the
ar tissue, beneath the skin. At first, there is hardening, with-

out pain, then swelling, followed by imperfect and slow suppuration; the skin becomes blue and thin, and the aperture for the discharge has ragged edges, revealing a dirty gray surface, with no granulations; the integument is soon undermined, and the ulcers communicate. The pain is slight, and the discharge is thin and serous. The system sympathizes and the result may be hectic.

*Treatment.*—Constitutional remedies should be steadily persevered in. Active measures must be taken to get rid of the soft infiltrated tissue surrounding, by escharotics; caustic potash must first be freely applied, and then a poultice; upon its removal a slough will be found to have separated, and the surface to be firm and vascular, covered with healthy granulations. The sore may then be treated as a healthy one, unless a relapse occur, when the application should be repeated. The constitution must be sustained, and the cicatrix supported by a bandage; otherwise it may ulcerate, especially if it is blue, soft, spongy, and elevated.

### INDOLENT ULCER.

This is the most common of all ulcers, and occurs most frequently in the lower extremity and in old persons. It is owing frequently to a healthy sore having been neglected or badly treated. Its surface is smooth, glassy, concave, and pale. The discharge is thin and serous. Its margin is elevated, round, white, and callous, resembling a cartilaginous ring surrounding a mucous membrane. The surrounding integument is swollen, hard, and of a dusky red colour. It has little sensibility, and the patient is apt to let it go unnoticed, unless by accident, exposure, or over-exertion, it inflames and becomes painful.

*Treatment.*—At first a poultice will be serviceable by cleansing he sore and diminishing the inflammation and pain which usually ecede the application for relief, which a purge and rest will assist a producing. The surface should be lightly touched with nitrate f silver or nitric acid, in order that healthy granulations should prout; or, pressure may be employed to produce the same effect by eans of strips of adhesive plaster and bandages. Small doses of pium are also useful in maintaining the capillary circulation.

### IRRITABLE ULCER.

This has been defined as possessing an excess of organizing action, ith a deficiency of organizable material. It is superficial, having unequal surface of a dark hue, and often covered with tenacious gin. It occurs most frequently near the ankle. The edges are in, serrated, and everted. The discharge is thin, acrid, and bloody. is very sensitive, attended with great pain, and produces often yishness of disposition.

*Treatment.*—Rest, elevation, and relaxation of the part. Nitrate

er produces a sedative and antiphlogistic effect. This should
owed by a light poultice, or warm-water dressing, or, if there
at pain, fomentations of the infusion of opium, conium, or
onna.

### PHAGEDENIC ULCER.

is of an irregular form, with ragged, abrupt edges, and
brown surface, looking as if gnawed by the teeth of an
. It is attended with burning pain, and great constitutional
ance.
requently assumes a sloughing form, as in hospital gangrene
ncrum oris, when the discharge is extremely fœtid.
*tment.*—Should be both constitutional and local. Fresh air
od diet are all-important; the secretions must be corrected
Dover's powder given at night. Locally, there should be ap-
ctive escharotics, such as nitric acid, nitrate of mercury, &c.,
d by warm poultices; these may be superseded by warm solu-
f the chloride of lime or soda. Mercury must never be given,
lly in cases of a venereal taint.

### VARICOSE ULCER.

is dependent upon a varicose condition of the veins, and
occurs in the leg, just above the ankle. They are oval and
cial, and attended with deep-seated, aching pain. They are
t, and usually moist upon the surface.
*tment.*—The cure must depend upon removing the disease of
ins. Great relief will be found in the constant use of cold
rest, regular bandaging, or laced stockings.
*tain ulcers are not to be healed,* for example, when an ulcer
en stationary for years, when the patient is old, gouty, or a
iver; it may be looked upon as a safety valve, and any ten-
to unite as indicative of impaired health. The sudden cessa-
a drain of pus might be followed by hemorrhage, apoplexy,
mmation of some important organ.

### ERYSIPELAS.

sipelas is an inflammation of the skin and subcutaneous cel-
issue, having a tendency to spread.
*cutaneous* form is characterized by redness, elevation, and
g pain; compression produces pale dimples, which soon dis-
, and the cuticle vesicates. It usually terminates in a week
, but may return to some other part.
*phlegmonous* or *cellulo-cutaneous* form is
g is greater, the colour darker, an
ichorous pus is formed, which infilt
us ulcerations and sloughs follow.

thirst; at first the fever is high, then there are signs of hectic, and at last prostration and collapse.

When it affects the head or throat, producing coma or dyspnœa, and when it occurs in feeble, old, or intemperate persons, there is great danger.

The causes may be fatigue, foul air, intemperance, epidemic influence, contagion, and injuries.

*Treatment.*—This must be adapted to the *age* and *constitution* of the patient; the young and plethoric will require most active antiphlogistic treatment constitutionally, whilst the old and broken down will need stimulants and tonics. In most instances, bleeding will be useful, followed by saline purgatives and diaphoretics. In highly inflammatory cases, an emetic administered early will also prove serviceable.

Bark will be necessary in the latter stages, if there is debility; opium will allay the restlessness at night.

The *local measures* most useful are leeches, punctures, cold lotions, if the pulse is good; and mercurial ointment, or nitrate of silver applied to the surface. Extension of the disease may be prevented by strips of blistering plaster, encircling the part.

Deep incisions are to be made in case there is pus collected under the skin.

Chronic, or habitual erysipelas, is best treated by alteratives and aperients.

## FURUNCULUS, OR BOIL.

Boils occur most frequently in the young, and in those of plethoric habit, and in those parts where the skin is the thickest. They are usually gregarious, and depend upon derangement of the primæ viæ, and frequently succeed eruptive diseases.

The swelling is of a conical shape, having a hard, red, and pain-ul base, and a yellow apex. If left to itself it bursts and dis-harges pus, and a core or slough of cellular tissue. When com-letely emptied the heat and pain subside.

*Treatment.*—Poultices and warm fomentations should be applied arly; as soon as pus has formed a free incision must be made; and e granulating wound dressed in the ordinary way.

## ANTHRAX, OR CARBUNCLE.

This is a serious disease; it is a solitary inflammation of the cel-lar tissue and skin, presenting a flat spongy swelling of a livid e, and attended with dull burning pain. It varies in size, and progress is slow.

The constitutional symptoms are asthenic throughout, and the tendant fever is apt to become typhoid; prostration and delirium rminate the case. It most frequently attacks high livers of anced age.

*tment.*—A free and early incision will evacuate sanious pus id sloughs; this is to be followed by applications of caustic in order that the dying parts may be thoroughly removed. es and warm fomentations will clean the surface, and give healthy granulations. Tonics and stimuli, such as bark, , ammonia, are early required, particularly if the carbuncle , and system debilitated.

### PERNIO, OR CHILBLAINS.

is an affection of the skin, produced by sudden alternations and heat, most commonly affecting the toes, heels, ears, or It is attended with itching, swelling, pain, and slight red- first; it may afterwards become of a livid hue, with vesica- nd ulcerated fissures, which are difficult to heal.

*tment.*—There is a great variety of applications in domestic this disease, and some of them of the most opposite character. ost serviceable remedy under all circumstances, but particu- hen there is ulceration, is the nitrate of silver. Temporary thing relief is produced by cold applications.

### FROST BITE.

re exposure, combined with exhaustion and fatigue, irresist- duces sleepiness, which, if yielded to, is followed by coma ath. When a part of the body is frost-bitten it becomes ted, pale, and insensible. It may take place without the usness of the patient; without care it terminates in gan-

*tment.*—Produce *moderate reaction*, which will restore cir- n and sensibility, taking care that it be *not excessive*, which lead to dangerous inflammation. First rub the part with nd then with cold water in a room without fire. For the se condition of the body produced by cold, also use friction ow, in a cold room, afterwards substituting flax or flannel; lly giving warm and stimulating drink, such as wine and

### BURNS AND SCALDS.

e are three principal divisions of these injuries, luced by hot fluids, vapour, flame, or solids.

Those which produce mere redness and sligh ting in resolution, and perhaps desquamatio

Those causing vesications of the cuticle, wh and heal; but if the cutis has been injured and inflamed, suppuration and ulceration result.

3d. Those causing the death of the part, in which there is not much pain, and which are followed by sloughs.

Extensive burns, even if superficial, are very dangerous; and those upon the trunk are more fatal than those of the extremities. The symptoms are paleness and shivering, with a feeble, quick pulse; often prostration, coma, and death. The greatest danger is during the first four or five days, from collapse; subsequently from an affection of head, chest, or abdomen, or from prostration.

*Treatment.*—Bathing the part in cold water will mitigate the heat, pain, and inflammation; afterwards it must be protected from the air by cotton, or some bland unctuous substance, care being taken to discharge the vesicles without removing the cuticle. Calm the nervous excitement with opium, and prevent sinking with wine and ammonia. Be careful of over stimulation, and promote the separation of sloughs by rest, poultices, and fomentations. Regulate the diet, and encourage granulations by water-dressings, saturated with salts of copper, zinc, or silver, or with chloride of lime. Contraction of cicatrices is to be prevented by mechanical means, and he function of joints is to be retained by passive motion.

## WOUNDS.

Wounds are classified into incised, contused, lacerated, punctured, oisoned, and gunshot.

### INCISED.

These are produced by sharp-edged instruments, and bleed freely. hey heal in various ways; *by adhesion*, or *union by the first intenon*, in which there is no suppuration. Fibrin is thrown out, and agulating, becomes organized, and constitutes a new living strucure; incorporated with the cut surfaces, it restores the solution of ntinuity in the solid parts.

Wounds heal by *growth*, whereby reparation is made, without flammation and suppuration, as in ordinary nutrition.

Wounds heal by the *modelling process*, which is somewhat similar the last, the gap gradually filling up with lymph, and restoring e deficiency.

Wounds heal by *granulation*, constituting union by *the second tention*, a process formerly described in treating of abscess.

*Treatment.*—This consists in arresting hemorrhage, removing eign bodies, bringing the edges together, and promoting adhen.

*Hemorrhage* is arrested by cold applications, elevated position, l compression, or, if an artery has been cut, by a ligature, or by sion.

*tures* are usually made of silk or thread, and should be ›r twisted, in order to divide the internal and middle coats of ›ry. Animal ligatures are sometimes used on account of ›eedy decomposition, and separation from the artery; liga- : lead have also been used.

*pression* can be effected by the tourniquet, bandages, and s of lint; in lieu of a tourniquet a Spanish windlass may be hich is made by tying a handkerchief around a limb, and ; it tightly with a stick.

*tics* are also used where the vessels are small, and the *actual* when the hemorrhage cannot be arrested by other means. ı bodies, such as pieces of glass, clots of blood, &c., &c., are ›moved from the wound, and the lips brought together by of adhesive plaster applied to surfaces cleanly shaved, and ›m moisture.

*res,* or stitches, are to be used only when the edges cannot ·oximated by other means. An *interrupted* suture is made ing a needle, armed with a single ligature, through both lips vound, which are then to be drawn together without any training, and secured by a double knot. These stitches are ıade at intervals of about an inch, but should not be made in ıdinous structure, or highly inflamed part.

*:isted* suture is made by transfixing the margins of the wound needle or pin, and passing around it a waxed ligature in the : the figure 8, by which means the edges are brought in con- he point of the pin, or needle, is to be protected with wax, owed to remain for several days.

*:ontinued,* or *glover's* suture, is nothing more than the ordinary f sewing cloth or leather.

### CONTUSED AND LACERATED.

›e resemble each other; are attended with little hemorrhage, : the arteries are torn, and do not bleed so much as when They are dangerous, because they are liable to inflammation ›ughing, and are often complicated with foreign bodies; and e more apt to produce constitutional disturbance and tetanus. *:tment.*—Adhesion is impossible; suppuration must take ınd the dead parts be thrown off; the reparation takes place ıulation. At first it will be necessary to arrest hemorrhage, foreign bodies, bring the parts in apposition by strips of 'e plaster, and apply water-dressings, or a light poultice, ac- ; to the condition of the patient. Cold and ot neans, such as bleeding and purging, must be us— here has been a great shock upon the system. of the parts will be depressed, and the ed; but after fever and suppuration are usual means of combating inflammation may be employed. When the sloughs are numerous, and the discharge profuse, typhoid symptoms will appear, especially if the patient be much reduced by depletion and rigid diet.

### PUNCTURED AND PENETRATING.

These are inflicted by sharp-pointed instruments, and are extremely dangerous, on account of the injury done to important parts, by opening vessels and cavities, and from the diffusion of purulent secretions, and the liability of tetanus.

*Treatment.*—After ascertaining that the wound contains no foreign matter, apposition is effected, and maintained by position, rest, and dressings, and the system placed under antiphlogistic regimen; adhesion is to be expected, or reparation by granulation. There may be severe secondary symptoms arising from secondary hemorrhage, or confined purulent secretions; it may be necessary to apply a ligature upon the artery above the ulcerated wound; or, to open and dilate it for the exit of pus, or a foreign body before undiscovered.

### POISONED.

These include bites and stings of animals, and the effects of dissecting wounds.

The stings of ordinary insects are not sufficiently severe to require surgical aid, unless in great number, and in peculiar situations. Children sometimes suffer with fever and headache, when tung in a number of places; and the suffocation produced by a ting in the pharynx is alarming.

*Treatment.*—For the common sting of a wasp or bee, remove the ting of the animal with forceps, should it remain, and apply some imulating application, such as turpentine, cologne water, or harts-orn. Hartshorn will probably give most relief, especially com-ined with cold applications. If there is faintness or depression, minister wine and opium. If the sting is in the fauces, use eches internally and externally, stimulating gargles, and, if neces-ry, open the trachea.

*Spiders*, especially the tarantula, *scorpions*, and *serpents*, inflict a ost severe injury. The bite of the *viper*, *cobra de capello*, and *ttlesnake*, is attended with great pain, swelling, constitutional dis-rbance, and death. In such wounds great caution must be used extract the poison from the wound, and to prevent its passing o the circulation. Surrounding the limb with a ligature, bathing wound with warm water, and sucking it, are all of use; but the lication of cupping glasses, and scarifications, is the most certain thod.

The prostration of the system is to be treated with brandy and ia, and the pain to be relieved by opium. Various remedies 'en internally, such as sweet oil and ammonia, but arsenic most decided preference; the celebrated Tanjore pills each a grain; the proper dose is fʒj to fʒij of Fowler's solution.

ROPHOBIA.—Hydrophobia is a disease brought on by inocuwith the saliva of a rabid animal, and characterized by inter- spasms of the muscles of respiration, together with a peculitability of the body and disturbance of the mind.

first symptoms in the dog are shyness, want of appetite, ıg of his tail and ears, a suspicious, haggard look, red and eyes, constant snapping at and swallowing straws, and lickd surfaces, such as stone and iron; afterwards respiration bedifficult, viscid saliva flows rapidly, and there is inflammation fauces, and high fever. He is not always furious, nor does ays bite, unless irritated; his gait is staggering, and he dies ulsions, usually after the fifth day.

symptoms in man vary with constitution and habit, and usupear between five and ten weeks subsequent to the bite.

wound heals as usual; after a time there is pain and itching cicatrix, which gradually increases, and ulceration follows. is headache, restlessness, fever, and excitement of the nerstem. The mind is particularly clear and active; the metrong, the imagination vivid, the countenance animated, and es sparkling. This is succeeded by despondency, and the of fluids, great agitation, spasms, difficulty of breathing. attempt to relieve the burning thirst is followed by convulntractions of the neck and throat; sleepless despair, change e, croupy inspiration, and involuntary biting are the next ms. As the disease advances, the brain becomes more afand death is preceded by delirium.

*tment.*—The recent wound should be treated by cuppingand nitrate of silver. In not more than one case out of does hydrophobia follow the bite of a rabid animal. The much less dangerous when through the clothes. After the is established, nothing can be done with the prospect of although every remedy and mode of treatment has been rended. Palliatives and medicines which calm the nervous and relieve pain may give some temporary relief.

ECTING WOUNDS.—These are followed by unpleasant results requently in those of a scrofulous temperament, or in those systems are exhausted by study or dissipation.

consequences may be a simple pustule, inflamm atics, and typhoid fever, with diffuse abscesses.

*pustule* has not much elevation, is surrounde tended with burning and itching. When op , thin pus, and is soon refilled, the excava creasing. This may not be followed by constitutional symptoms, unless the health is very bad.

The inflammation of the lymphatics is more apt to follow a small scratch or wound from examining recent subjects, especially those dying with peritonitis or any disease of serous membranes. The pain and swelling extend up the arm to the axilla, and there is fever and depression of spirits. The course of the inflammation can be traced along the lymphatics to the axillary glands, which often suppurate.

Extensive abscesses and typhoid fever take place when the poison is very violent and the system much prostrated.

*Treatment.*—The pustule will be managed best by a lye poultice, and then removing the coverings and touching the surface with lunar caustic. A simple incision or puncture for an ordinary pustule will not prevent the renewal of the matter.

When the lymphatics are inflamed, the original wound is not always the most tender spot, nor is there the appearance of a pustule. Leeches, cold applications, poultices of Indian meal and rye, nitrate of silver, and tincture of iodine are useful local applications. Bleeding may be necessary when the inflammation and fever are very high. Free incisions prevent the formation of abscesses, by evacuating the serum and depleting the part. Spreading abscess of the cellular tissue is attended with typhoid fever, and very dangerous. The system must be supported by stimulants and tonics, such as brandy and bark; opium will allay pain and restlessness, and the local dressing will resemble that for abscess in general.

Fresh air, clean clothes, healthy skin, good diet, and regular habits will be found to be the best prophylactics.

## GUNSHOT WOUNDS.

These include all injuries by fire-arms, and partake of the nature of lacerated and contused wounds. There is usually but little hemorrhage, unless a large vessel is injured. The nature and extent of the injury will vary with the distance, force, and character of the shot or slug producing it, and the part affected; fracture, contusions, and perforations may require amputation. The aperture made by the entrance of the bullet often appears smaller than the bullet, and resembles an incised wound with inverted edges; the aperture of its exit is larger, and has ragged and everted edges. The pain of a flesh wound is often so slight that it does not attract attention; but when a bone is broken or a nerve torn, the pain is severe. The shock upon the system is greater than in other wounds, and is partly corporeal and partly mental. Syncope and depression of spirits are very common attendants.

The idea of injury resulting from the *wind of a ball* is erroneous.

s may result from spent balls, which, having a rotary motion,
ll over the surface without producing an open wound.

course of bullets is uncertain; any obstacle, such as a button,
ı, or a bone, may occasion a most devious track. A ball may
he forehead, and emerge at the occiput, or, striking the ster-
odge in the scrotum. A bullet may be divided into two
y striking a sharp edge of bone; or it may bury itself, and
concealed for years, being enclosed in a cyst.

n there is but one aperture, it is probable that the ball has
; though it may have escaped upon the removal of the cloth-
a portion of the clothing should have been carried before it
e wound; or, the ball may make a complete circuit, and
by the aperture of entrance; in this instance the track would
overed by redness and swelling. When two orifices are in a
t line, it is not always to be inferred that the ball has escaped,
balls may have entered opposite each other; the character
orifices will determine this point. A plurality of openings
t always imply a plurality of balls; the same bullet may per-
ınd escape, and perforate again.

wound partially sloughs and may produce abscess, erysipelas,
hage, disease of the bones, hectic, or tetanus.

*tment*—The general indications are to overcome the shock,
foreign matters, adjust the parts, and place them in a com-
e and relaxed position.

mple wound, made by a ball passing through some fleshy part
at first be sponged clean, and after hemorrhage has ceased,
with dry lint, secured by strips of plaster. A little wine
danum may be given if the patient is disposed to faint, or
much with anxiety and fear. In a few days there is inflam-
and suppuration. The primary dressings are to be removed
ırm water, and a poultice or the water dressing substituted.
ust be taken that the sloughs are readily thrown off, and that
ıses are formed. The constitutional treatment should be
tely antiphlogistic; consisting of purging, low diet, leeches,
rhaps bleeding; an opiate at bedtime will allay pain and
ng.

presence of bullets and other foreign bodies can be detected
obe, and they are to be removed by a forceps, the wound
been dilated, if necessary. If they are superficially lodged,
e to be cut down upon, extracted by a counter opening; if
e deep-seated and impacted, wait for the suppurative stage.
lodged in bone, they may be removed by a chis
ey produce caries or necrosis, although in m
ıve become encased and occasioned no inconven
question of amputation will be settled by con
y of gangrene, the usefulness of the limb if retain

habits, and strength of the patient, and the means at hand for carrying out the treatment. The latter consideration will justify more numerous amputations in military and naval than in civil surgery. The following circumstances make amputation necessary.

When a limb is completely knocked off by a cannon-ball. If the bone is shattered and the joint endangered, it should be amputated above the joint.

When the femur is fractured, and the femoral artery or vein, or the sciatic nerve is lacerated.

When large joints are injured; but that of the elbow may often be excised.

When the main artery is wounded, and gangrene has commenced and is spreading.

## TETANUS.

Is a disease of the true spinal system, and is manifested by spasm and rigidity of voluntary muscles.

When the muscles of the neck and face are affected, it is termed *Trismus*, or locked jaw; when the muscles of the front, *Emprosthotonos;* when the muscles of the back, *Opisthotonos;* bending to either side is termed *Pleurothotonos.*

Tetanus may be either an *acute* or *chronic* disease; the former is the most frequent in occurrence, and most formidable to treat; the latter, apt to be partial, milder, and more subject to treatment.

*Traumatic* tetanus follows a wound or injury, and is usually acute; *idiopathic* tetanus is of spontaneous origin, and usually chronic.

Acute traumatic tetanus is more frequent in hot climates, and in military practice, and may follow a slight bruise or puncture, especially if some nerve has been injured. Intestinal irritation and atmospheric changes predispose to the disease.

The symptoms may appear in a few hours, or in as many days; at first there is stiffness and soreness about the neck and face, the contraction of the muscles causing a ghastly smile; swallowing and mastication are difficult, the forehead is wrinkled, eyeballs are distorted, nostrils dilated, and the grinning countenance is expressive of horror. Respiration is rapid, the tongue protrudes, and saliva dribbles; the sphincters are usually contracted, perspiration is profuse and of a peculiar odour; the pulse at first may be strong and full, but soon becomes weak and indistinct. The mind is clear until just before death, which generally takes place in a few days.

*Treatment.*—The indications are to remove all sources of irritation, and diminish the spasm. The wound is to be cleansed from all foreign bodies, pus to be discharged by a free incision, if necessary, and warm anodyne poultices and fomentations are to be applied. Excision of the wound, or division of the nerve leading to it, has ractised with great benefit. Bleeding should be employed reat care, and purgatives combined with mercury are always antage. Opium is almost indispensable, and may be used lly and internally. Camphor, musk, assafœtida, and tobacco o of use as antispasmodics.

onic tetanus is seldom fatal, and frequently idiopathic; it everal weeks, and should be treated by the shower-bath, and electricity. Ether or chloroform may be used with age.

## DISEASES OF BONES.

### CARIES.

es is an unhealthy inflammation of the bone, attended with ng, and leading to suppuration and ulceration. The bone has ls filled with serous, and often with scrofulous fluids, and ried has a spongy and worm-eaten appearance, and resembles of sugar after being dipped in hot water. The disease most ntly attacks the thick bones, and the extremities of long and it may result from local injury, or simply from consti- l causes, such as scrofula, or effects of mercury. It is d with pain and swelling, and after ulceration there is a ischarge containing portions of bone.

*tment.*—The constitutional treatment consists of fresh air, and alteratives; and the local treatment in removing those s incapable of repair, and endeavouring to establish healthy tions. Sometimes it may be necessary to remove loose por- f bone which are disintegrated, and to apply escharotics to face.

### CARIES OF THE SPINE.

occurs most frequently in children, and in persons of a ous temperament. At first there is a sensation of numbness lower extremities, languor, and a stumbling gait. The patient sits with his legs drawn up under the chair, has a constric- the chest, and derangement of the digestive organs; in a ime paralysis ensues, and there may be a pointing of matter e portion of the spinal column, most frequently about the vertebræ. The bodies of the vertebræ are softened and com- l, and thus a curvature takes place; the convexity of which frequently directed posteriorly. Many die from fever and on, and recovery is usually attended with defor

*tment.*—Absolute rest upon a mattrass, atte l health, counter-irritations over the tender ers and issues, and in the early stages, leech should be light and nutritious, and a laxative administered occasionally.

### NECROSIS.

This signifies the death of the bone, which is often enclosed in a case of new bone. When a superficial layer is affected it exfoliates; the dead portions thrown off are termed *sequestra*. It occurs at all ages, and most frequently in the compact bones; the immediate cause, is inflammation of the periosteum. It is attended with swelling, and a discharge of matter through openings in the case of new bone, which are termed *cloacæ*. The pain is deep-seated, long-continued, and very severe.

*Treatment.*—This is principally local, although constitutional remedies may be given to allay pain. The great object is to facilitate the escape of pus and the sequestra; it is often necessary to enlarge the cloacæ by a saw or trephine, and to dilate the sinuses with lint. Amputation may be necessary in case the joints are involved.

### EXOSTOSIS.

This is a tumour formed by an excessive and irregular growth of bone. The shape varies, being sometimes broad, and sometimes spiculated. The structure is healthy, and it may cause no inconvenience, unless it interferes with an artery, muscle, or joint.

*Treatment.*—The object is to produce absorption, by means of mercury, iodine, blisters and leeches; but since these usually fail, it is necessary to resort to an operation. This may be performed by a saw or trephine. Scraping off the periosteum is also recommended.

### FRAGILITAS OSSIUM.

This is a brittleness of bones, occurring frequently in youth, but oftener in old age. The proportion of earthy matter is relatively but not actually increased. The cancellated structure is filled by an oily substance, and surrounded by a thin, brittle lamella. This degeneration follows long confinement, intemperate habits, and rheumatic and cancerous affections. A hasty step, turning in bed, or tripping on a carpet, may produce fracture.

*Treatment.*—In old persons all that can be done is to guard against any accident, and to enjoin a nutritious diet and salubrious atmosphere. In children, care should be taken to overcome a scrofulous constitution by tonics and good diet, and to treat the fracture as usual.

### MOLLITIES OSSIUM.

This is a deficiency of the earthy matter of bones, and hence

e soft and pliable. This disease occurs in adults, and its course
. ; the general health is impaired ; flesh, spirits, and strength,
h daily. The bones are light, soft and greasy, and often
of an external shell, filled with a soft, greasy matter. The
ı obscure ; phosphatic deposits are found in the secretions.
*tment.*—This is merely palliative, for the disease is in-
.

### RICKETS.

is an original defect of the skeleton, peculiar to youth and
ous temperaments. The bone is changed in its structure, be-
soft and pliable, as in mollities ossium. The cancellated
re predominates, the cells being filled with a reddish oily fluid.
t bones are often thickened, and the long bones atrophied in
ıft. This disease gradually increases with age, and hence
eformity, and curvatures of limbs must necessarily occur.
t life, the general health may be regained, and the patient,
a confirmed and unseemly dwarf, weak and puny in his boy-
ıay prove a healthy, muscular, and active man.
*tment.*—Improvement of the general system by diet, exercise,
clothing, and tonics. Mechanical apparatus, properly con-
l, may be of service in preventing permanent deformity.
ırticles of diet which are readily converted into lactic acid,
sugar, starch, gum, milk, &c., should be avoided, and animal
easy digestion preferred.

### SPINA VENTOSA.

is a swelling, usually of considerable extent, involving the
circumference of the bone, and has a regular surface. In
ıstances, it is a bony shell, containing one or several cavities,
ith an ichorous fluid, clotted blood, and portions of carious
It is preceded by severe pain, and external injuries and
ıtional causes may give rise to it. It is difficult to cure,
lly in adults.
*tment.*—When the tumour is small, the cure is to be effected
ns of puncture, satisfactory evacuation, external support, and
l stimulation of the cavity. If the tumour is large, and the
health affected, amputation will be necessary.

### OSTEO-SARCOMA.

is a tumour, composed partly of bone and part
lly considered of a malignant nature. A *di*
presents a dense, pearl-coloured membrane,
, and adhering closely to the bone ; above this me
s are thin and spread out, so as to cover an extens

having lost their colour. Upon opening the tumour, it will be found to contain cells divided by spiculæ of bone, and materials resembling flesh, jelly, and fat. It is attended with deep-seated pain, and at last bursts, assuming a cancer-like ulceration.

*Treatment.*—At first, leeches, cold applications, and anodynes, may give temporary relief, but no permanent benefit can be expected without its removal; and even after amputation, it frequently attacks the stump.

### COXALGIA.

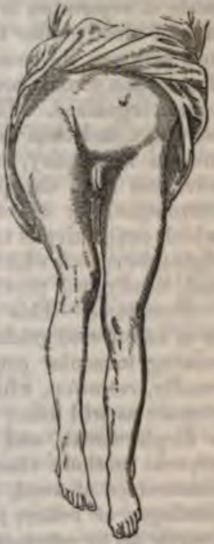
This is a disease of the hip-joint, common to scrofulous children.

*Symptoms.*—At first there is slight pain, referred to the knee; lameness, and stumbling in walking; tenderness in the groin, and pain is produced by pressing the head of the bone suddenly against the acetabulum; apparent lengthening of the limb. This apparent increase of length is owing to a depression of the pelvis of the diseased side, the weight of the body being supported on the opposite limb.

If the disease is not arrested, destruction of the head of the bone and acetabulum results, and the femur is drawn up, constituting a spontaneous luxation. Often an abscess forms, and opens externally. The toes may be turned inward or outward.

*Treatment.*—Perfect rest upon a mattrass, as in caries of the spine, the limb being confined in a carved splint. Cups and leeches, over the joint, will be useful at first; subsequently, more benefit will be derived from counter-irritation by blisters, setons, and issues. Purging with jalap and cream of tartar, tonics, and iodine, are the constitutional remedies. It may require months or years to effect a cure.

Fig. 1.



### FRACTURES.

Fracture is a solution of continuity of a bone, produced by external violence, or muscular contraction. Fractures are divided into oblique, transverse, and longitudinal, according to the direction. *Simple* fracture is a mere separation of the bone into two parts; *compound*, implies an open wound, communicating with the fracture; *comminuted*, when the bone is broken into numerous fragments; and *complicated*, when attended with luxation, laceration of large vessels, &c.

*signs* of fractures are deformity, preternatural mobility, cre-
, pain, swelling, and helplessness of the part. Old age, and
diseases of the bone, predispose to fractures; in cold weather,
e more numerous, on account of the increased muscular ex-
necessary in walking, where there is ice. Indirect violence
casion fracture, when a force is applied to the two extremi-
a bone, which gives way between them. Deformity may be
d by an angular derangement, or a derangement in the direc-
the axis, the diameter, or the circumference of the bone.
ones are occasioned by a few of the osseous fibres giving
on the convexity of the curve. The process of reparation
rapid in the young, and also takes place sooner in a small
a large bone. Danger results, according to the site of the
the nature of the fracture, and the state of the system. The
f reparation is attended by the following changes: extravasa-
blood; after this is absorbed, the liquor sanguinis is effused,
sumes the position which the blood occupied; this consoli-
the serous portion is absorbed; the fibrin remains, and be-
organized. This period of plastic exudation lasts for eight or
s, and then becomes cartilaginous. This mass contracts, in-
in density, and gradually becomes bone. The ossification
es from the periphery. The fractured extremities are now
ded by a bony case, termed the *provisional callus;* after
continuity is truly restored by the formation of what is called
*ve callus,* which takes place between the fractured extremities;
ally, the provisional callus is absorbed.

*tment.*—This consists of two parts; first, *reduction,* which
effected gradually by extension and counter-extension, over-
muscular contraction, and coaptating the extremities; se-
*retention,* which is effected by keeping the limb in such a
as will relax those muscles which would be likely to cause
acement, and by applying such mechanical means as will
t motion; these means consist of splints, which are variously
cted of wood, pasteboard, or metal, and applied by means of
es or rollers; they should be light, and always of such a
as to command the neighbouring joint; the inner surface
be padded or lined, in order to prevent chafing. After being
, the part should be laid upon a pillow, and not disturbed,
there should be inordinate swelling of the limb, when the
e should be loosened. Bandages soaked in gum or starch,
cently been used, in place of splints. Under certain circum-
, this dressing is admirable, but an indiscrimina-
nds manifestly to injury; on account of the swel
t produces pressure, which may occasion ulceration
It is called the immovable apparatus.

diet should be watched, and antiphlogistic means r if necessary. At the end of three to six weeks, the provisional callus is complete, and the substitutes for this splint of nature can be discontinued; the use of the part must be resumed gradually, especially in the lower limbs.

### FRACTURE OF THE NOSE.

The nasal bones are usually fractured by a fall, a violent blow, or kick of a horse, or some direct application of force. This fracture is often attended by injury of the brain, and followed by caries and exfoliation.

*Treatment.*—This consists of antiphlogistic means, such as leeches, cold applications, and rigid diet, to remove swelling and inflammation, and the adjustment of the fragments; which can be accomplished by a catheter, probe, or dressing forceps. The nose should not be plugged with lint, unless to check profuse hemorrhage. The parts may be retained in apposition by compresses and rollers.

### FRACTURE OF THE MALAR AND SUPERIOR MAXILLARY BONES.

These can only occur by the most direct violence, or gunshot injuries, and are usually attended with crushing and wounding of the soft parts; severe inflammation and nervous symptoms may come on, and the brain may also be affected. There will be great pain and difficulty in chewing.

*Treatment.*—If there is no displacement, there is nothing to be done but to subdue inflammation, and keep the parts quiet. If the alveolar processes are loosened, they must be pressed into their places, and the mouth kept shut, and the patient nourished by fluids.

### FRACTURE OF THE LOWER JAW.

This may occur in the base of the jaw, in the ramus or processes; and in children it may take place at the symphysis. The most frequent seat of fracture is between the chin and the insertion of the masseter muscle; the longer fragment and the chin is depressed. In double fractures, the chin alone is depressed. There is pain, swelling, inability to move the jaw, irregularity of the dental arch, crepitus, and frequently hemorrhage and deafness. The diagnosis of fracture of the ramus and condyle is often obscured by swelling; the neck of the condyle is drawn forwards by the external pterygoid muscle, and crepitation will be perceived by the patient.

*Treatment.*—The teeth serve as a guide in the adjustment of the fragments, and the upper jaw acts as a splint in the retention. A compress and a pasteboard splint, retained by a suitable bandage, will retain the parts in apposition; and the patient is to be fed by

and soups, through the interstices of the teeth. The union
l, and there is usually but little deformity.

### FRACTURE OF THE SPINE.

is attended with serious injury to the spinal cord, from com-
n, laceration, bruising, concussion, or from subsequent in-
tion and softening. When it occurs above the fourth cervical
a, death is almost certain, on account of the origin of the
nerve which supplies the diaphragm.
n the lumbar region has suffered, the symptoms are paralysis
lower limbs, involuntary discharge of fæces, retention of
and frequently priapism.
n the injury is in the upper dorsal or lower cervical region,
, in addition to these symptoms, paralysis of the arms, diffi-
f breathing, sluggishness of the bowels, and distension of the
n. In all fractures of the spine, the kidneys suffer, and bed-
re apt to follow.
*tment.*—Absolute rest upon a mattrass, low diet, and anti-
tic means, to prevent the formation of pus, and thickening
membranes. The discharges of the bowels must be regu-
nd the bladder relieved by the catheter; counter-irritation
ictions will be useful in the latter stages of the case. The
the trephine in this injury has not met with success, and will
ly do more harm than good.

### FRACTURE OF THE PELVIS.

ture of the bones of the pelvis can only be produced by the
t violence. There is but little displacement, although great
results from injury to the parts within.
*tment.*—All that can be done is to place the patient at rest
asy position, keep a catheter in the bladder, and make inci-
if urine or pus is extravasated in the perineum. The appli-
of a broad bandage around the hips, will assist in preventing
.
n the crest of the ilium or the anterior superior spinous pro-
knocked off, the fragment is displaced inwards, and can be
ted by the fingers. Fracture of the sacrum is longitudinal
, and there is no displacement. The coccyx may be frac-
by a kick, and is displaced inwardly: re-adjustment may be
l by the finger in the rectum. The acetabulum may be split,
jury of the neck of the femur may be simulated, though there
hortening of the limb, and crepitus is felt by the fi
, when the pelvis is moved.

### FRACTURE OF THE RIBS.

ribs are very liable to fracture, which usually is i dle, when occurring from direct force, or force applied at each end. Displacement is seldom great, and is difficult to detect in fat persons. There is pain, swelling, and difficulty in breathing; crepitus is felt, when the hand is placed over the part during respiration or coughing; emphysema appears when the pleura is injured.

*Treatment.*—If there is an angular projection of the extremities, a compress is to be applied over it; if there is a depression, a compress is to be placed at each extremity; the chest is to be surrounded by a roller, in order to prevent respiration by the intercostal muscles, and thus to keep the parts at rest. Inflammation and cough are likely to ensue, and must be treated by antiphlogistic means and anodynes.

Compound fracture of the ribs is treated of, under the head of Wounds of the Chest.

### FRACTURE OF THE STERNUM.

Fracture of this bone is rare, great violence being necessary to produce it; injury usually is done to the thoracic viscera. The deformity is generally a depression, and the symptoms are great difficulty of respiration, pain, palpitation of the heart, and perhaps spitting of blood, and cough. Caries, or a pulmonary affection, often result from a fracture of the sternum or ribs in scrofulous habits.

*Treatment.*—The local treatment consists of a compress and a roller, applied upon the same principles as in fracture of the rib. The general treatment must be adapted to the inflammatory conditions of the organs of the chest. Collections of pus and blood behind the sternum can be evacuated with a trephine, but the operation is often attended with unfavourable results.

### FRACTURE OF THE SCAPULA.

The *acromion* process is sometimes fractured; the shoulder loses somewhat of its roundness, the head of the humerus falls slightly, and there is a slight depression at the point of fracture. It is distinguished from dislocation by mobility of the joint, and crepitation can be felt by rotating the head of the humerus.

*Treatment.*—It may unite by bone, but generally it unites by ligament. It is to be kept in its place, by elevating and firmly fixing the os humeri; this is effected by placing a cushion between the side and the elbow, and retaining it by a roller, the elbow being carried a little backwards. If the pad be placed in the axilla, and the elbow be brought close to the side, the fragments will be separated; but little inflammation follows, and bandages may be removed in three weeks. In many individuals, the tip of the acromion process is slightly movable, being merely united by ligament.

The *neck of the scapula* is rarely fractured, and it is liable to be

n for a dislocation; the shoulder falls; there is a hollow be-
acromion, from a sinking of the deltoid muscle; and the
the humerus can be felt in the axilla. It can be recognised
facility with which the parts are replaced, the falling of the
f the bone into the axilla, when the extension is removed,
crepitation.

*tment.*—The first point is to carry the head of the humerus
ls, and the second to raise the glenoid cavity and arm. The
is effected by a thick cushion confined in the axilla by a
e, and the latter by placing the arm in a short sling. Ten
ve weeks are necessary to procure union, and a still longer
recover the strength of the arm.

*coracoid* may be fractured by direct violence; the process is
downwards, by the action of the coraco-brachialis, pectoralis
and biceps muscles. There is pain, swelling, and crepita-
the part, and loss of power in the limb.

*tment.*—This consists in making the fingers of the injured
ouch the shoulder of the opposite side, the position being
by bandaging.

*body* of the scapula may be fractured either vertically or
rsely, and there is but little displacement, unless it is near
ver angle of the scapula. When the angle is fractured, it
drawn forward and upward.

*tment.*—This consists of a tight roller around the chest; the
ing placed in a sling.

### FRACTURE OF THE CLAVICLE.

fracture is frequent, and is usually produced by violence
he shoulder, arm, and hand. It is generally oblique, and
e middle of the bone; the part is painful and swollen, and
ttempt at motion produces pain; the shoulder is sunken,
wn towards the sternum, and the acromial fragment is drawn
rd by the weight of the arm, and forward and inward by
on of the subclavius muscle. The patient usually supports
with his other hand, to relieve the pressure upon the axil-
xus of nerves. The indications are plain, viz.: to elevate
ulder; to keep it outward from the chest; and to draw it
backward.

*tment.*—The mode of dressing this fracture is extremely
. *Dessault's apparatus* consists of a compress placed over
ture, a wedge-shaped pad placed in the axilla, and retained
ller which surrounds the chest. The elbow is t
ide, and the arm and chest surrounded by circ
d roller, whereby the shoulder is elevated and
A third and last roller commences at the ar
ide, and being carried obliquely over the compre

the posterior portion of the arm, passes under the elbow, and obliquely upwards across the chest to the armpit, whence it started; then over the back to the shoulder of the affected side, across the compress, down in front of the arm, under the elbow, and across the back to the sound armpit again. This bandage serves to retain the arm and shoulder in its elevated position.

*Fox's apparatus* consists of a wedge-shaped pad, secured by strings to a circular collar which surrounds the shoulder of the sound side, and a sling made of linen, which contains the forearm; it elevates the shoulder, and, by bringing the elbow to the side, draws the shoulder outwards.

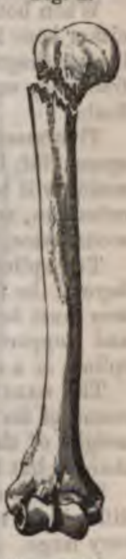
Some use merely a pad and two handkerchiefs, which, if properly applied, can be made to fulfil all the indications.

Some deformity almost always results.

## FRACTURE OF THE HUMERUS.

The *anatomical neck* is the seat of fracture in young persons, and sometimes in old. There is little or no flattening of the shoulder, owing to the head of the bone remaining in its place; the end of the shaft is directed obliquely upwards and forwards, and projects on the coracoid process; the arm is shortened, and crepitus is distinct after slight extension and coaptation of the fragments.

Fig. 2.



*Treatment.*—This requires a pad in the axilla, a splint on the fore and back part of the arm, a roller, and a sling for the hand, the elbow hanging free.

*The Surgical Neck.*—The upper fragment remains in its place, but its lower extremity inclines slightly outwards; the upper end of the lower fragment is drawn upwards and inwards under the pectoral muscle; the shoulder is round, the arm shortened, the elbow abducted, and there is crepitation upon adjustment.

*Treatment.*—A pad is placed in the axilla; two splints secured by a roller; the hand supported by a sling, and the elbow free.

*Fracture at the Neck* may be accompanied with *dislocation.* This is recognised by the tumour in the axilla, formed by the head of the bone, which does not move when the shaft is rotated.

*Treatment.*—An effort should be made to restore the head of the bone, and then to coaptate the extremities: this is often impossible; then the extremity of the lower fragment should be brought to play in the glenoid cavity. A pad will be necessary in the axilla, and the same dressing as the last. A new joint is formed, and the motion of the arm are only partial.

*shaft* may be fractured at any point, and is easily recognised
pitation; and when the fracture is just below the surgical
he lower extremity of the upper fragment is drawn inwards
muscles inserted into the bicipital ridges, and the upper ex-
r of the lower fragment is drawn outwards by the deltoid
.

*tment.*—The reduction is easy, and the extremities may be
d in contact by four small splints placed around the arm,
ured by a roller, which, as in all other instances of its use in
per extremity, must commence at the hand. The forearm
be suspended in a sling.

*condyles* are fractured in various ways. Either condyle may
tured, most frequently the internal; or, there may be a frac-
tween the two condyles, and another separating them from
ft. These injuries are distinguished from dislocation at the
by mobility and crepitation.

*tment.*—By a roller and two angular splints (Physick's),
g to the hand from the middle of the arm. The angle of
ints must be changed to prevent anchylosis. Some deformity
ffness often remain.

### FRACTURE OF THE RADIUS AND ULNA.

n both bones of the forearm are fractured at once, or when
bone is fractured near the middle, there is but little difficulty
diagnosis, being easily recognised by the ordinary signs of
es, such as pain, crepitus, swelling, and uselessness of the

*tment.*—The great object is to preserve the interosseous
for, if the fragments unite at an angle, supination and pro-
will be prevented. The fracture is readily reduced by slight
on, and then the muscles should be pressed into the interos-
pace, in order to separate the two bones.

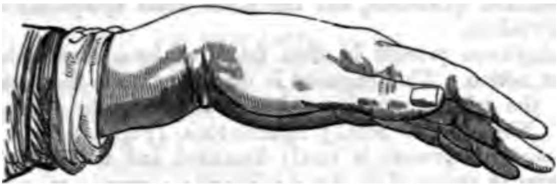
splints, well padded on the inside, reaching from the elbow
the fingers, should be applied, and retained by a roller. The
ust be kept in a position between supination and pronation,
pported by a sling; after two or three weeks pasteboard
or a starch bandage may be substituted.

RADIUS is more frequently fractured than the ulna, on ac-
of its articulating with the carpus, and thus receiving the
of the body in falls, &c. When fractured near the middle
s but little deformity, the ulna acting as a splint.

*neck* of the radius is but rarely fractured, and the ac
t to recognise, especially when the muscles cover
rge. It is to be discovered by fixing the head of
ating the hand and forearm.

The *lower extremity* of the radius is often fractured, and frequently mistaken for a dislocation of the wrist. (Fig. 3.)

Fig. 3.



Fractures of the radius are to be treated upon the same principles, and by the same means as in other fractures of the forearm, unless the fracture should be through the articular surface of the carpal extremity of the radius. This latter fracture gives a peculiar deformity to the wrist, dependent upon a partial luxation of the carpus. In this instance, besides the ordinary splints, two small compresses are to be applied, one upon a prominence on the dorsal surface caused by the fragment, the other upon the projecting extremity of the radius on the palmar side. Of course these compresses will not be opposite to each other. Passive motion should be established in

Fig. 4.

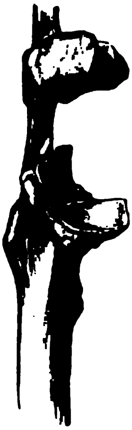
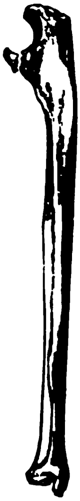


Fig. 5.



, for fear of anchylosis, and the loss of the pulley-like motion
extensor tendons on the back of the radius.

ULNA is most frequently fractured below the middle of the
The lower fragment approximates the radius by the action
pronator quadratus, and the other usual symptoms of frac-
e evident.

*olecranon* process is often fractured by sudden violence, or
ar action. The fragment is drawn up upon the back of the
r the triceps muscle, and the deformity is increased by
The union is usually ligamentous. (Fig. 4.)

*coronoid* process is rarely fractured, and usually by inordi-
uscular action of the brachialis anticus muscle, whose tendon
·ted in front of the base of this process. Dislocation back-
by the action of the triceps may result. The union will be
ntous. (Fig. 5.)

*itment.*—Fractures of the shaft are to be treated by two
and compresses, as are those of the radius. Fracture of the
on is to be treated by extending the elbow, placing a small
n front of the joint, and securing it by a roller. The coronoid
: treated by flexing the elbow, the fingers touching the oppo-
oulder, applying a roller to relax the muscles and prevent
ction, and keeping the forearm in a sling to the utmost.

## 'RACTURE OF THE CARPUS, METACARPUS, AND PHALANGES.

bones of the carpus are seldom fractured. The injury is
' a compound one, and produced by direct force.

metacarpal bones are subject to simple fracture, which is
recognised by pain, swelling, crepitus, &c. The treatment
s of coaptation of the fragments, and retaining them by
of two splints and interosseous pads, or compresses.

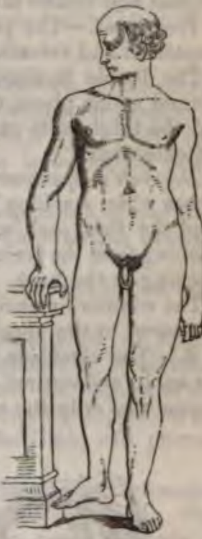
*phalanges* are liable to compound and simple fracture. Sim-
ctures to be treated by two or four small splints, and a narrow
;e; when several fingers are broken, a carved splint will be

## FRACTURE OF THE FEMUR.

*neck* may be fractured within the capsule. This occurs most
ntly in old persons, and in females, on account of the bony
: being more brittle in advanced life, and on account of the
iical character of the neck of the femur in women. The
it may be produced by a slight fall, muscular
&c. The head of the bone remains in the acetal
fragment is drawn upwards by the muscles of t
ot is everted, owing to the action of the rotat
nb is shortened, the trochanter is one or two inches

flatter than its fellow; there is pain, crepitus, and want of voluntary motion. The arc which the trochanter, upon rotation, will describe, will be of a much smaller circle than that described by the rotation of its fellow.

Fig. 6.



Union is possible, but improbable; on account of the difficulty of coaptating the fragments, the want of provisional callus, the fractured extremities being bathed in an increased quantity of synovia, and the feeble nutrition of the head of the bone through the round ligament. Yet, in a young person of good constitution, where the periosteum is not completely severed, there may be bony union. Ordinarily, there results a false joint, thickening of the capsule, partial absorption of the fragments, and the patient is lame for life, and requires a stick or crutch. Feeble old women may die from the shock of the injury, or from the irritation of pain and confinement.

*Treatment.*—Extension and splints are unnecessary—the limb should be supported by pillows, and motion restrained. Care should be taken with reference to bed-sores, sloughs, &c.

The *neck* may be fractured partly within and partly without the capsule, in which case the prospect of union is much more favourable. Or, the extremity of one fragment may be driven into the cancellated structure of the other, constituting an *impacted* fracture; in these cases, crepitus is obscure, the displacement is slight, and there is considerable power and motion of the limb, and but little shortening and eversion. They are produced by great direct force, and are attended with great pain, swelling, and constitutional disturbance. The treatment may be successful in many instances, without the use of splints.

The *trochanter major* may be fractured; the process is drawn upwards by the glutei muscles, and a space can be felt between the fragments. Approximation and retention are difficult, and the union generally ligamentous. The cure is to be effected by rest, position, and relaxing the muscles.

Fracture of the condyles is a serious injury, especially when communicating with the joint. After the fragments are somewhat consolidated by rest and position, passive motion must be established to prevent anchylosis.

Fracture of the *shaft* is easily recognised by shortening, crepita-

c. &c. The deformity is greater when it occurs in the upper
pecially when just below the tronchanters, the lower end of
er fragment being tilted forward by the action of the psoas
and iliacus internus muscles.

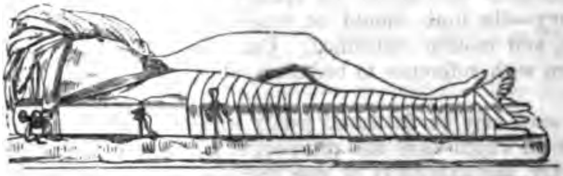
*tment.*—The principles of treatment are, as in all fractures,
ion and retention, but the means to effect it are various.

double inclined plane is a simple contrivance. The leg is
to one plane, which furnishes the means of counter-extension
thigh rests on the other; the weight of the body produces
ension.

*ault's Apparatus.*—Consists of an outer splint, three or four
wide, reaching from the crest of the ilium to four inches be-
e foot, each extremity having a hole in it; an inner splint
g from the perineum to the sole of the foot, and an upper splint
g to the knee.

counter-extension is made by a band in the perineum, which
ed to the upper end of the outer splint by means of the hole
The extension is made by a band or handkerchief applied to
le, and secured to the hole in the lower end of the outer splint.
uses only the outer splint, as represented in the figure.

Fig. 7.



*Physick's modification* consists in an elongation of the outer
nearly to the axilla; by this means counter-extension is made
e more nearly parallel with the axis of the body, and a block
ced upon the inner side of the lower end of the same splint,
he foot, for the purpose also of preventing the line of exten-
ing oblique, which might produce pain and deformity. Bags
are placed on each side of the limb, so as to secure uniform
e from the splints, and the whole is secured by bandages.

*edorn's Apparatus* consists of one splint reaching from the
a foot-board.

counter-extension is made at the acetabulum of the sound
d the extension by the foot of the injured side. The splint
applied to the outer side of the sound limb,
to the foot-board; and the extension is made
t of the fractured limb down to the foot-board
is avoids the necessity of a perineal band,

*Dr. Gibson's modification* of this apparatus consists in an elongation of the splint as high as the axilla, which will prevent any lateral inclination of the body; and the application of a similar splint to the fractured limb.

### FRACTURE OF THE PATELLA.

The accident may result from muscular contraction or direct violence. It is sometimes attended with an audible snap and falling of the patient; the pain is not severe, and a simple fracture is not dangerous. The limb is bent partially, and there is no ability to extend it.

The direction is usually transverse, and a separation of the fragments can be felt. There is no crepitus. Considerable swelling usually follows.

Longitudinal fractures are rare, and are not attended by the same symptoms.

*Treatment.*—Leeches and lotions should be applied to reduce swelling and inflammation, and then the limb should be extended, a roller and figure of 8 bandage applied to coaptate the fragments and compress the muscles of the thigh. A long splint, reaching from the ischium to the heel, applied to the back of the limb, will prevent motion.

Bony union is not to be expected; a strong ligamentous connexion is usually formed, which answers the purpose extremely well. Passive motion should be made after five or six weeks. Sixty or seventy *days* will elapse before the limb can be used; and even then, caution should be taken that the newly-formed ligament be not broken. The patella of the opposite side is liable to fracture; for it possesses the same structure which predisposed to fracture in the other limb, and there is increased muscular exertion of the sound limb.

### FRACTURE OF THE LEG.

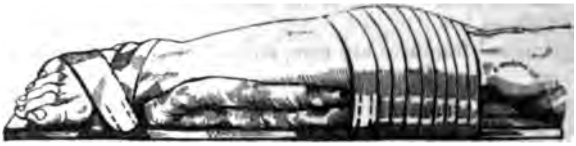
A frequent accident, occurring in one or both bones, from a fall or direct violence. The *tibia* is most frequently fractured, on account of its exposed position, and sustaining the weight of the body. The fracture may occur at any part, but the deformity is greater, as it may be nearer the lower extremity; if nearer the upper extremity the deformity may be slight and the patient even walk about.

The fibula may be fractured by direct or indirect force. Little deformity results, unless the fracture is below its middle. When nearer the ankle, dislocation may be produced. The most frequent seat of fracture is from two to three inches above the malleolus. There is immediate lameness; the foot is turned out; crepitus is distinct, and a depression exists over the fractured part.

*Both bones* are often fractured at once by falls or blows; they t the weakest points. The signs are evident: crepitus, pain, f motion, &c. There is seldom any great shortening, and ormity is readily reduced.

*tment.*—When both bones are fractured, when the tibia s fractured, or, when the upper part of the fibula is fractured, t and most simple apparatus is the fracture-box and pillow. cture-box has a foot-board, to which the foot is secured by a e, thus preventing any lateral inclination. In lieu of this, lints of the length of the leg, applied on either side of the will answer the purpose, care being taken to support the foot ndage or handkerchief.

Fig. 8.



tures of the lower end of the fibula are to be treated by Du- n's or Physick's apparatus; which consists of a single splint, on the inner side of the leg, and reaching beyond the foot. rovided with a wedge-shaped pad, which reaches only to the the larger end of which being applied to the internal malle- a bandage is carried over the ankle in such a manner as to e inversion of the foot, making the sole of the foot approxi- he splint, and thus fragments are adjusted and the deformity d.

## FRACTURES OF THE BONES OF THE FOOT.

*os calcis* may be fractured by great violence connected with ion of the sural muscles. The tuberosity will be drawn up tendo Achillis, and the patient is unable to stand.

*treatment* consists in overcoming the action of the triceps lexing the leg upon the thigh, and extending the foot upon The fragments are to be approximated by a figure of 8 e.

*astragalus* is rarely fractured; it may occur at the posterior here the tendon of the flexor longus pollicis plays over it; or occur between the body and the head. In the first instance t will be inverted, in the latter but little deformity will occur. n be *treated* successfully by a simple fracture-box. Should take place it may become necessary to extirpate it.

*metatarsal* bones and the *phalanges* are seldom fractured, the injury be complicated or compound.

it, especially the knee-joint, is opened; if large arteries are the soft parts are extensively lacerated or bruised, particu- he patient is old or enfeebled by disease.

*reatment*, if it be determined to try to save the limb, will vert the fracture into a simple one, by arresting bleeding, g pieces of bone, clots, &c., so the wound will heal without ion. To reduce the protruding fractured extremities, it necessary to saw off a portion; to arrest the hemorrhage, it useful to envelope the parts in bran, or stuff the opening , which must be removed as soon as suppuration occurs. ubsequent part of the treatment may require antiphlogistic, e frequently tonic measures, such as bark, wine, good diet, ecially if the discharge is profuse. Secondary amputation necessary at last.

## DISLOCATIONS.

ation or luxation, is the removal of a bone from its articu- vity. The ball and socket joints are most liable to the

*redisposing causes* are the peculiarity of the construction of , weakness or paralysis of the muscles, elongation of the li- , particular position of the parts, accumulation of fluids in , or diseases and fractures of the bones.

*xciting causes* are external violence; such as blows, falls, muscular contraction.

*mptoms* are deformity, swelling, and a hollow where none e, shortening or elongation, pain and immobility of the limb.

*nsequences* are rupture of ligaments, effusion of blood and

muscles which retain the bone in its unnatural position, and
bringing the head of the bone into such a situation that the
of the muscles may draw it into its place.

*stitutional* means are often necessary to effect reduction in
rger joints, such as bloodletting, warm baths, emetics, in
to produce relaxation of the muscles. The local means are
sion and counter-extension. The extension must be made gra-
, in order to overcome the action of the muscles, and to place
ead of the bone in such a situation as to be drawn into its
and the extension must be withdrawn suddenly, in order that
uscles may have the effect by their contraction.

treatment subsequent to the reduction consists in maintain-
e limb at rest, and applying leeches and cold applications to
e swelling and pain. Afterwards, if any stiffness remains,
lating friction may be used.

*bluxation* implies a partial removal of the head of a bone from
iculating surface. *Recent* and *old*, are terms applied to luxa-
with reference to the period which may have elapsed, and the
es which may have occurred by adhesions, &c.

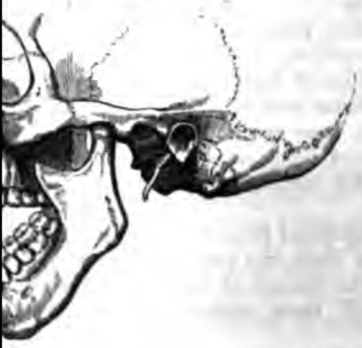
*npound Luxation.*—This is connected with a wound in the
ments, fracture of bone, laceration of large vessels, &c. The
principles apply as in compound fracture. The same contin-
s of age, temperament, and constitution, will influence the
ent. The question of amputation is first to be considered,
en the reduction. The after treatment would be that for a
l of the joint: careful closure of the wound,—prevention of
mation by antiphlogistic means; if possible preventing sup-
on, anchylosis, and tetanus.

## DISLOCATION OF THE JAW.

location of the jaw may be caused by spasm of the pterygoid muscles when yawning, or by a blow on the chin when the mouth is wide open. The condyles are pushed forwards, and rest in front of the base of the zygomatic process of the temporal bone.

*Symptoms.*—The mouth gapes and cannot be shut, the glenoid cavity is vacant, and there is a prominence felt beneath the zygoma; the saliva trickles, articulation is prevented, and there is great pain.

Fig. 9.



*Treatment.*—The patient should be seated on a low stool, and the surgeon standing in front, should press his thumbs, properly protected, upon the last molar teeth, at the same time elevating the chin with the fingers. The condyles are thus extracted from their unnatural position, and returned to their socket by the normal action of the muscles, which produces an audible noise. In difficult cases, greater leverage may be obtained by using two forks or strong pieces of wood, connected by a string in such a way that it will elevate the chin, whilst the ends are pressed against the teeth in place of the thumb. When the resistance is great the efforts may be directed first to one side at a time.

After reduction, the chin should be confined by a bandage for a week or ten days.

### DISLOCATION OF THE SPINE.

This accident rarely happens unless connected with fracture; although it has occasionally occurred in the cervical vertebræ.

It may be produced by the muscular effort of convulsion and mania, but more frequently is the result of violence; for instance, falls from a height, crushing by wheels, hanging, &c.

The chance of life is but small on account of injury done to the spinal marrow. The displacement is easily recognised by the deformity, paralysis, &c.

Dislocation of the atlas upon the dentata may occasion instant death, by the intrusion of its tooth-like process into the spinal marrow. Dislocations of the oblique processes simply may terminate with no other inconvenience than contortion of the neck and restricted motion of the head. The action of the diaphragm may be suspended by compression of the phrenic nerve.

Dislocations of the bodies of vertebræ of the neck and back, are almost necessarily accompanied by fracture.

*Treatment.*—But little is to be expected. Great care is required in extension and coaptation. In the neck, danger is to be apprehended from an attempt to reduce the deformity. Contusion of the muscles may produce a deformity which may resemble dislocation.

*Subluxation* or *partial* dislocation is more common; and it may terminate without permanent injury to the spinal marrow; provided the antiphlogistic system is pursued in all the details of rest, diet, purging, cups, &c.

### DISLOCATION OF THE RIBS.

The *vertebral* extremity of the ribs can only be dislocated by severe falls, or blows upon the back, on account of its double articulation, and its protection by the muscles of the back. The *sternal* extremity is sometimes loosened from the cartilage by violent bending of the body backwards;—great pain and difficulty of breath-

ows. Reduction can be effected by deep inspiration, slightly
; the body backwards and making some pressure on the
ng point. The subsequent treatment is the same as that for
; of the rib.

### DISLOCATION OF THE CLAVICLE.

clavicle may be dislocated at either extremity, and is more
an fracture.

*ternal* end may be dislocated upward, backward, and forward.
).) When dislocated upward, the sternal extremity approaches
ow, and is much more elevated than the acromial extremity.
dislocated backward, which is more rare, there is a depression
e articulation, pain and stiffness in the neck, and difficulty
lowing. When the direction is forward, which is the most
t, it is produced by force applied at the opposite extremity.
aracterized by a projection over the spot, inclination of the
the affected side, pain upon moving the arm, and the shoulder
ght near to the chest.

*reduction* is easy,—by means of extension and counter-exten-
ere is more difficulty in preventing a recurrence of the acci-
Dessault's apparatus for fractured clavicle should be applied.
en with the greatest care, greater or less deformity commonly
s, which, however, does not interfere with the motions of the

*scapular* end is generally dislocated upwards. Although
nes it slides beneath the acromion. It is usually the result
ll; and is recognised by pain, impeded motion, depression of
ulder, and the clavicle resting on top of the acromion occa-
projection.

action is effected by elevating the shoulder and depressing
responding end of the clavicle. Dessault's bandage is then
pplied, and the part kept at rest. Some displacement usually
s, which does not prevent motion of the shoulder.

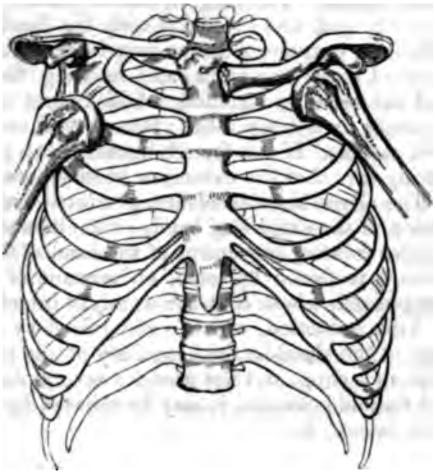
### DISLOCATION OF THE ARM.

is the most frequent dislocation, on account of the mobility
shoulder joint, its constant exposure to injury, and the shal-
s of the glenoid cavity, compared to the size of the head of
merus.

ay be displaced in three directions; viz., inwards, downwards,
ckwards. In dislocation inwards, the elbow stands out from
dy, and is inclined a little backward; a protub
h the pectoralis major muscle, and there is frequ
the limb.

lislocation downwards, which is the most c
the arm is lengthened, and there is gre

Fig. 10.

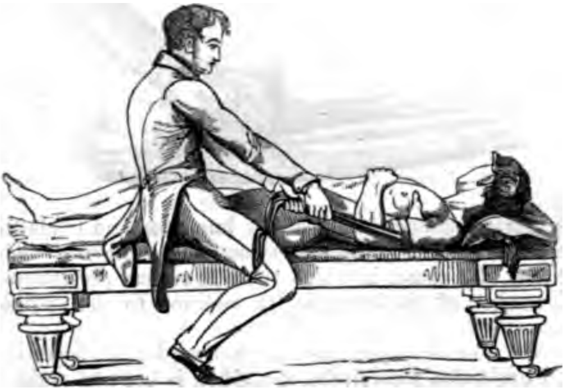


immobility; the elbow stands out from the body; there is a hollow under the acromion process, and a prominence in the axilla.

In dislocation backward, which is most rare, the elbow is inclined inward and forward, the head of the bone forms a prominence beneath the spine of the scapula, and there is a hollow beneath the acromion, together with rigidity and immobility.

Violence and contraction of the muscles pectoralis major, latissimus dorsi, teres major, and deltoid, are the causes of dislocation of the arm. The immediate injury is a laceration of the capsule, contusion of the muscles, and effusion of blood, and often paralysis of the deltoid muscle from compression of the axillary nerve. Unless reduction is effected the parts become united by adhesions,—after which reduction cannot be produced without danger of lacerating the artery.

Fig. 11.



*reduction* is managed in different ways. The ordinary plan lace the patient on the bed, and then to place a spherical pad axilla. The surgeon makes counter-extension with his foot he pad, and extension with his hands. If this force is not nt, counter-extension may be made by passing a folded towel et under the axilla, and securing the ends to the bed-post; tension by fastening a folded sheet or long towel to the wrist w by a damp roller; thus several assistants can make exten- once. If this force is not sufficient, pulleys may be employed, care that the extension be made very gradually.

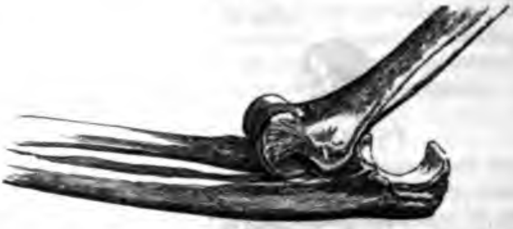
elbow has this advantage over the wrist, as a point of appli- of the extending band,—the elbow can be bent, and thus a r rotatory movement of the head of the bone produced. The s preferred by some, on account of there being no muscles essed, whose contraction might interfere with the reduction.

er reduction, which is recognised by cessation of pain, rotun- f the shoulder, and mobility of the limb, the arm should be n a sling, and not used for several days. Should paralysis of ltoid continue, it may be relieved by stimulating lotions, blis- noxas, &c.

### DISLOCATIONS AT THE ELBOW.

en both radius and ulna are dislocated at the elbow, the fore- bent nearly at a right angle, and is immoveable. The ole- forms a prominence behind, and the articular extremity of merus, covered by the brachialis anticus muscle, forms a pro- nce in front. The coronoid process of the ulna is received

Fig. 12.



e greater sigmoid cavity of the humerus, and tends to main- e bones in their unnatural situation. A *lateral* dislocation s may also occur, in which there is a great projection of the al condyle of the humerus, in addition to the symptoms of st variety.

en the ulna alone is dislocated backwards, the olecranon forms ed projection posteriorly, the elbow is bent at right angles, e forearm is pronated.

e in front, the arm is slightly bent, but cannot be com-
xed, and there is some pronation.
*luction* is effected by making forcible extension and pro-
the same time, if the displacement be anteriorly; if the
ent be posteriorly, supination is to be produced with exten-
both, the head of the bone is to be pressed upon by the
thumb, in order to facilitate its sliding into its proper

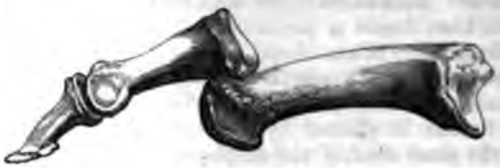
ion at the elbow occurs but rarely, on account of the gin-
haracter of the joint, and is generally accompanied by
le laceration of the soft parts. Rest, cold applications, and
e subsequently required, together with general antiphlo-
ns.
oduced, most frequently, by force applied to the wrist,
complicated with fracture of any of the processes, anchy-
grene, and other dangerous results may follow, especially
ction is delayed, and adhesions have formed.

## DISLOCATIONS AT THE WRIST.

*lius* and *ulna* may be separated from the carpus, either
or posteriorly. When dislocated *forwards*, there is a great
in front, and the hand is bent backwards; when back-
projection is behind, and the hand is flexed.
duced by violent bending of the hand, and is accompanied
of the ligaments and stretching of the tendons. The
is easily effected by extension and pressure. Pain, swell-
tiffness of the joint may follow, which are to be obviated
plications, rest, lotions, &c.; if there should be a tendency

y there is a dislocation of the *phalanges* of the fingers, but requently the dislocation backwards of the first phalanx of mb upon the metacarpal bone.

Fig. 13.



uction is effected by making extension in a curved line, by of a narrow bandage or tape, firmly applied by a clove-hitch he phalangeal extremity. In some instances it may be necessary divide the lateral ligament.

### DISLOCATIONS OF THE FEMUR.

ocations of the thigh may occur in five directions:—1st, up- and backwards, on the back of the ilium (Fig. 14); 2d, in-

Fig. 14.

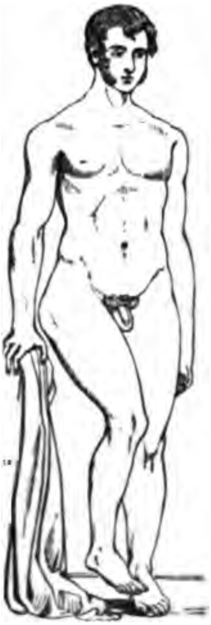
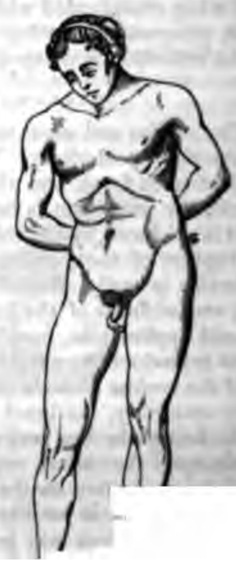


Fig. 15.



wards and downwards, into the foramen ovale (Fig. 15); 3d, backwards, into the ischiatic notch (Fig. 16); 4th, upwards and forwards, on the horizontal ramus of the pubes (Fig. 17); 5th, downwards, under the tuberosity of the ischium. The first is the most common, the fifth is the most rare.

Fig. 16.

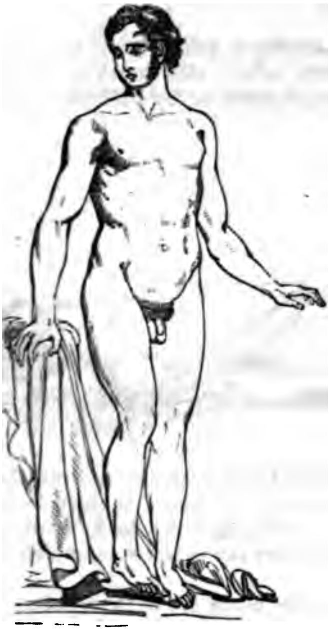
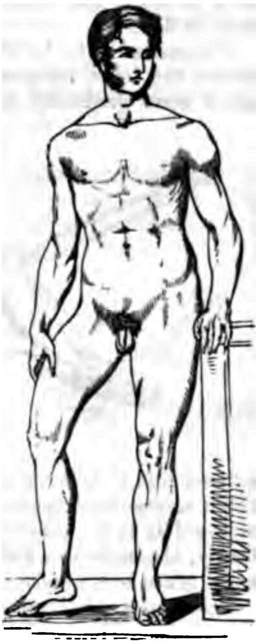


Fig. 17.

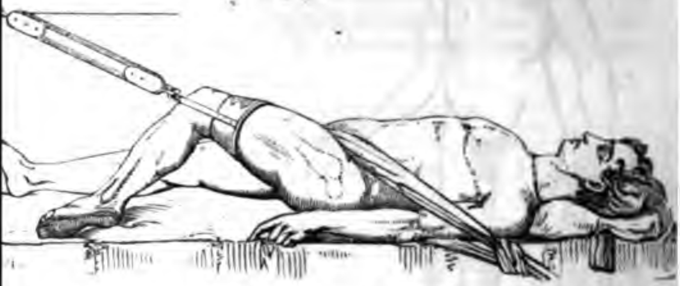


In the most frequent displacements *upwards and backwards*, the limb is shortened from an inch and a half to two inches and a half; the toes rest on the opposite instep; the knee is turned inwards and slightly bent; the limb may be bent across the other, but cannot be moved outwards; the trochanter is less prominent, and nearer the spine of the ilium; and if the patient is thin, and there is no swelling, the head of the bone can be felt in its new position, and the rounded form of the hip is lost. It is to be distinguished from a fracture of the neck of the bone by the position of the foot and the rigidity of the limb.

The reduction is the most difficult of all dislocations, and must be attempted as soon as possible after the displacement. If it is not produced, thè head of the bone will adapt itself to its new position e formation of a new cavity, and the patient will gradually be to walk, the toes merely touching the ground. Bleeding, a bath, and tartar emetic must be administered, according to atient's constitution, in order to produce relaxation of the es. Counter-extension is to be made by a folded sheet or towel placed in the perineum, the patient being in the recum-position, and secured to a ring or hook firmly fastened in the or floor.

tension is to be effected by securing a folded towel or sheet the knee, by means of a damp roller; this towel is to be upon gradually, by numerous assistants or by pulleys. The

Fig. 18.



sion is to be made gradually, in such a direction as to draw the across the opposite one, a little above the knee. A third band vel is to be passed around the pelvis, in order to fix it more , the ends of which are to be tied on the sound side, which is given to an assistant.

locations *backwards* in the sciatic notch are next in point of ency. The head of the bone rests on the pyriformis muscle, en the sacro-sciatic ligaments and the upper part of the , a little above the level of the middle of the acetabulum. hortening and inversion of the foot is not so great as in the ariety; the head of the bone can seldom be felt; the joint remely rigid, and motion of the limb almost impossible. In ing this dislocation it is necessary that the head of the bone l first be brought out of the notch, before it can be restored to etabulum.

locations *downwards and inwards* are comparatively rare; the s elongated nearly two inches; the foot is advanced, though r inverted or everted; the thigh is abducted, and cannot be ht near to its fellow; the psoas and iliacus muscles form a ridge can be seen or felt; the trochanter is flattened and depressed, e space between it and the anterior superior spinous process of the ilium is much increased. To reduce this form, counter-extension is to be made outwards by a band across the upper and inner part of the thigh: extension is to be made at the knee, which is gradually to be made to approximate its fellow.

In dislocation *upwards and inwards*, the head of the bone rests upon the horizontal portion of the pubes, under Poupart's ligament, where it forms a tumour. The limb is shortened an inch, and the foot is turned outward, and cannot be rotated. The reduction is effected by extension in the axis of the body.

Reduction of the thigh is indicated by an audible noise when the head of the bone returns to its socket, by the natural length and direction of the limb, by the cessation of pain, and the free motion of the joint.

After reduction there is sometimes a slight elongation of the limb, which depends upon the swelling of the ligaments of the joint. The patient should be kept at rest, and may require antiphlogistic treatment; walking should not be attempted for several weeks.

### DISLOCATIONS OF THE KNEE.

Dislocation at this joint is rare on account of its great strength. The displacement may be forwards, backwards, and laterally; it is usually incomplete and readily reduced.

The reduction is accomplished by extension of the leg and coaptating the extremities of the bones. Subsequent inflammation and its results, anchylosis, suppuration, &c., are to be avoided by strict antiphlogistic means; sustaining the weakness of the joint by splints or rollers, and removing the stiffness by lotions and frictions.

The *semilunar cartilages* are sometimes displaced by twisting the joint, especially if an unusual relaxation of the ligaments should exist. The limb is immediately rendered stiff, and the pain is severe and sickening. Extreme flexion usually is sufficient to restore the parts to their position, although the pain and swelling remain for some time and require attention.

### DISLOCATIONS OF THE PATELLA.

The patella may be dislocated anteriorly, posteriorly, and laterally. *Outwards* is the most frequent displacement, and is characterized by the leg being stretched, a prominence externally formed by the patella, and a projection internally of the internal condyle.

Reduction is effected by raising the leg and resting the patient's heel on the surgeon's shoulder, thus relaxing the muscles of the thigh; at the same time the patella is to be forced into its place with the hand. This bone can only be displaced *upward* by a rupture of its tendon, and *downward* by a laceration of the rectus muscle. It may be displaced by semi-rotation, one edge resting on the trochlea 'emur, and the other forming a prominent ridge. Extreme and coaptation will reduce it.

### DISLOCATION AT THE ANKLE.

accident is usually the result of severe force, and accom- by fracture of the malleoli. The displacement may be for- ackward, inward, and outward.

ication of the tibia *inward* is the most frequent, and owing cture of the external malleolus, the foot is everted and the l malleolus greatly projects.

*iction* is effected by extension of the foot and flexion of the as to relax the gastrocnemius muscle. Dislocation of the itward is occasioned by a fracture of the internal malleolus, deformity is the reverse of the last. Dislocation backwards sult from a fracture of the posterior extremity of the astra- n which instance the foot is inverted as in varus; this is ire than dislocations forward, which result from fractures of 'er end of the fibula. There is danger of suppuration and ie, especially if connected with an external wound. Ampu- vill often be the best resort, particularly when the constitu- the patient is bad.

### DISLOCATION OF THE BONES OF THE FOOT.

*astragalus* is more frequently dislocated than any bone of sus; and it may either be forward or backward. Unless re- can be effected, which is difficult, excision of the bone may ssary, or amputation at the ankle. Dislocation of the other f the tarsus are usually compound injuries, and are to be upon general principles.

## INJURIES OF THE HEAD.

### THE SCALP.

*usion* of the scalp may be very severe, on account of its tretched over the resisting bony surface of the cranium, and 'requently connected with a lacerated wound. Owing to its rity, great swelling will occur from extravasation of serum or in many instances a fluctuating tumour being produced be- he integuments. The swelling which results being readily ed in the middle, may give rise to the idea of a fracture, is to be carefully diagnosticated.

*treatment* will require cold applications. In no im of blood to be evacuated by incision or punct n is to be promoted and depended upon, ever . It may be that the clot will produce infla ation; then a free incision should be made, a the pus favoured. Healthy granulation contracts the cavity, and the wound unites by the formation of a cicatrix.

The constitutional treatment required may be different in the early stages from the latter, being antiphlogistic or tonic, as the symptoms demand.

### WOUNDS OF THE SCALP.

Simple incised wounds of the scalp give little trouble but that of hemorrhage, which is best arrested by a ligature or torsion; a curved needle will be found more convenient to secure the vessels than the tenaculum. The edges are to be drawn together by adhesive straps, in preference to stitches, on account of the danger of erysipelas. When a large portion of the scalp is lacerated, and hangs like a flap, it is not to be cut, even though it is attached by a very small process; but, after being carefully cleaned, it is to be adjusted accurately, and retained in its place by proper bandaging. It thus protects the bone from exposure, and by granulation becomes firmly united to the adjacent parts. Blindness may result from a wound upon the forehead injuring the supra-orbital nerve.

### CONCUSSION.

By this is meant a jarring or shaking of the brain without any great lesion, though function is temporarily impaired; inflammation is apt to follow. The force may be directly from a blow upon the head, or indirectly, from alighting upon the feet. The patient is stunned, is somewhat insensible, lies motionless, pale and cold. Insensibility is not complete, for questions will be answered, and pain manifested by pinching; respiration is feeble, the pulse is rapid, small, and fluttering; the pupils are insensible to light, sometimes contracted, and sometimes dilated; nausea and vomiting often follow. After reaction, inflammatory symptoms commence, the pulse becomes full and hard, the skin hot and dry, the face flushed, the eyes bloodshot, great pain, especially in the head, restlessness and delirium.

*Treatment.*—In the first stage, that of prostration, the chief care of the surgeon is to prevent some bystander from bleeding the patient, in common with the vulgar notion. No active treatment should be resorted to until reaction has taken place. In the mean time the patient should be undressed and put to bed, and his limbs carefully examined; the head should be shaved, wounds dressed, &c.

Should the prostration continue, and danger impend from syncope, stimulation is to be resorted to in the most gradual and cautious manner; warm frictions are to be employed, small quantities of tea, wine, and water are to be administered with care, lest they pass into the air-passages, and produce asphyxia. After reaction commences, stimulants are to be suspended, lest they increase subsequent inflam-

. By hurrying on reaction, life is often endangered, as by
early abstraction of blood. So soon as inflammatory symp-
airly manifest themselves, we should endeavour to repress
y excluding all kinds of excitement, especially light and noise,
the application of ice and evaporating lotions to the head,
should be elevated upon pillows. If great reaction occur,
sting itself by delirium, convulsive movements, a full and
pulse, pain, &c., local and general bleeding, together with
a and purgatives, are to be resorted to; opium will also have
ficial influence if administered judiciously, especially in con-
with calomel and tartar emetic. For some time after the
e of the inflammation has subsided, the brain remains weak
quires watchful care; excitement, both physical and mental, is
voided, the diet regulated, and the head kept cool. The me-
s often impaired, the conversation childish and incoherent,
wild and vacant in its expression, the demeanour either most
nd gentle, or entirely the reverse; occasionally one or more
special senses, such as hearing or smell, is lost; such conse-
s may be temporary or permanent. The treatment most
e is a mild mercurial course, long-continued counter-irritation,
ed diet, avoidance of all excitement and exposures to changes
ther, together with the use of the cold shower-bath.

## FRACTURES OF THE CRANIUM.

se occur more frequently in adults than in children, on ac-
of the unyielding and brittle nature of their bones, whereas
es of a child's head are pliable, and yield to the force without
e. Fractures of the cranium are classified, by the extent of
into simple fissure, stellated, depressed, and camerated frac-
fractures of the external or internal table, &c. The dangers
ant are various; there may be concussion, compression, hemor-
and inflammation of the brain and its membranes.
*mple fissure* is of but little importance, even should it be ex-
, and traverse a suture, which it often does. The fracture
requires no treatment, unless accompanied by symptoms of
sion, compression, or inflammation.
*cture at the base* of the cranium is a very serious injury, and
attended with laceration of the membranes, and internal
hage. It is usually suspected, from the early appearance of
ms of compression, the manner in which the injury was
d, escape of blood from the ears, and sometim
nd mouth. The latter symptom, although gen
most dangerous one, may be the result of m
lining membrane of the ear or the nose. The
will be that for inflammation or compression.

### A DEPRESSED FRACTURE.

This is to be carefully diagnosticated from a fracture of the external table alone, and from a depression in the middle of a tumour occasioned by the effusion of lymph. It is dangerous, from the complications of concussion, compression, extravasation of blood, and inflammation. The treatment consists in removing the cause of compression, and combating the effects of inflammation; the former by the operation of trephining, and the latter by strict antiphlogistic means.

### COMPRESSION.

Compression may be the result of extravasated blood, depression of the bone, or the formation of pus. The symptoms which characterize it are slow, laborious, stertorous respiration; a full, regular, slow pulse, and complete loss of consciousness and sensibility; the muscles are relaxed and powerless, pupils dilated and insensible, the skin warm and moist, and the sphincters often relaxed. The patient may perish immediately from coma, or may rapidly recover from the removal of the cause of depression.

Extravasation of blood may take place immediately upon the infliction of the injury, or not until reaction has followed; concussion often being produced at the same time. The extravasation may be situated between the bone and the dura mater, which is the result of a wound of the meningeal artery. This may be the result either of a direct blow, or of a counter stroke. The symptoms gradually appear, and if urgent, the trephine should be used, and the blood, if fluid, escapes at once. If the symptoms be not severe, the clot may be absorbed, and the brain gradually recover from the compression, provided high inflammatory action is prevented.

Blood may be effused within the membranes, or within the ventricles; most frequently being the result of injury to the vessels of the pia mater. The clot effused *within* the membranes is usually larger, and will produce more dangerous symptoms than one *external* to them. The most dangerous consequences result from a clot at the base of the brain.

*Treatment.*—The objects are to prevent increased effusion and diminish subsequent inflammation, and the removal of the clot. The head should be elevated, cups and cold applications applied, with general bloodletting and purging. The action of the heart is to be diminished, in order to prevent the further extravasation of blood. The removal of the clot is accomplished by trephining, and opening the membranes. If, however, the clot is at the base of the cranium, or it is uncertain where it may be, the membranes are not to be opened, for the chances of inflammation would be much in-

by the operation, and the cause of compression not certainly
d.

*pression resulting from the formation of pus*, does not exhibit
inary symptoms rapidly, as in the case by the escape of
ıor do the symptoms subside so readily; because pus is not
ıable to absorption as blood. It cannot be discharged but
exfoliation of the bone, which is a tedious process. The
ms denoting the formation of this dangerous abscess, affect
tem as well as the part; and the patient would manifest the
estlessness, rigor, and fever, which attend the formation of
other parts of the body.

### TREPHINING.

scalp is first to be cleanly shaved; and if a wound already
he cranium may be exposed simply by enlarging it; but if
ious wound exist, an incision is to be made, of a crucial,
lar, or semicircular shape,—the latter being most preferred.
ricranium is then to be detached by a scraper, unless the
e have an additional means for removing it. That portion of
ıium should be selected which is sufficiently near the injured
allow of elevation of the fragments, by the introduction of
ator, and at the same time to be sufficiently firm to bear the
e of the trephine. The sinuses of the dura mater, the occi-
oss, and the course of the middle artery of the dura mater,
e avoided. The centre-pin of the trephine is to be withdrawn
groove is made sufficiently deep for the play of the teeth of
rument; and great care is to be taken, lest the trephine saw
the bone unequally, owing to the want of parallelism of the
les of the skull. The progress of the operation is to be
sly watched, and the depth of the groove made by the
e, ascertained by a toothpick or a small probe. The button-
tion of bone frequently comes away in the trephine; if not,
e removed by a forceps or elevator; the rough edges (should
st) of the internal table, are to be taken away by an instru-
alled a lenticular. Through the opening thus made, the
may be introduced, or the extravasated blood may escape.
ening is subsequently filled up by a dense membrane, formed
pericranium and dura mater. The edge of the opening is
at altered by absorption, and some deposit of bone. In
stances of compound fracture of the skull, a prominent angle
sawed off with Hey's saw, and thus an opening be formed
tly large for the admission of the elevator, or th
clot.

## INJURIES AND DISEASES OF THE FACE, NOSE, AND MOUTH.

Wounds of the face are usually attended with considerable hemorrhage, which sometimes requires the tying of an artery. Care is required to approximate the edges, in order to prevent deformity, and an ugly cicatrix. When the supra-orbital nerve is injured, vision is impaired; when the portio dura nerve is cut, paralysis of the muscles upon one side of the face results.

### WOUNDS OF THE EXTERNAL EAR.

Do not affect the hearing; but when the cartilage is cut, a split will remain, unless the integuments are carefully united.

### WOUNDS OF THE EYEBALL.

Produced by great violence, such as gun-shot wounds, of course destroy the sight, and are often followed by a fungous growth, which requires removal and the substitution of a glass eye.

### WOUNDS OF THE TONGUE.

Bleed very copiously, and there is some difficulty in arresting hemorrhage. This is to be effected by a ligature and styptics; and, if necessary, by the actual cautery. Sutures are necessary to approximate the edges of the wound.

### SALIVARY FISTULA.

This results from a wound or ulcer of Steno's duct, by which the discharge of the parotid gland opens externally on the cheek, occasioning great inconvenience and deformity, and interfering with the processes of mastication and digestion. A cure is to be effected by making an opening through the mucous membrane of the cheek, that the saliva may enter the mouth, and by closing the fistulous orifice. The edges of this orifice will require caustic, or paring with a sharp knife, or the actual cautery, to make them unite, and the internal orifice is to be kept open by a tent.

### EPISTAXIS.

This implies hemorrhage from the nostril, produced by injury, plethora, or diseased state of the blood and mucous membranes. The treatment will, in a great measure, depend upon the cause. The arrest of hemorrhage by external applications, is only to be made under certain circumstances; it will be effected by an upright position, cold applied to the head and back, astringents thrown up the nostrils, and compression by lint. In some instances, the lint is to be introduced through the posterior nares, by means of Belloque's canula, or by a flexible catheter and a piece of string, where be allowed to remain for several days; in many instances, tional treatment is necessary.

## FOREIGN BODIES IN THE NOSTRIL.

beads, and such like substances are often inserted by thought- dren: and by unwise efforts at removal, they are more deeply n the cavity. The surgeon is to inject a stream of warm to the nose, which will wash away any coagula of blood, and he foreign body; its position is to be discovered by a probe, can be extricated by a scooped end of a director or forceps. of snuff will sometimes dislodge it.

## POLYPUS OF THE NOSE.

are different varieties of polypi: the most common is a us, pyriform mass, attached to the mucous membrane of the ed bones. The patient has a sensation of a cold in the hich is much increased in damp weather. It interferes with ion, and frequently alters the tone of the voice. The sense is also impaired, and deafness may be produced, should it the orifice of the Eustachian tube. It may be removed by ; it off by the forceps; and the hemorrhage is to be arrested ngent injections and lint. *A dense fibrous polypus* is best l by a ligature or wire, applied by means of a double canula, purpose of strangulation. *Malignant polypi* may be regarded able.

## LIPOMA OF THE NOSE.

ypertrophied condition of the skin and fat of the apex, and he nose; seldom occurring but in aged free-livers. When wth is large, it is to be removed by the knife.

## OZÆNA.

obstinate, profuse and fœtid discharge from the mucous ne of the nose, with disease of the bones beneath. The often extends to the frontal sinus and antrum. In adults, ten dependent upon syphilis, or the abuse of mercury; in , upon scrofula.

*reatment* will in a great measure be constitutional, although nd comfort will be derived from the use of astringents and washes, and promoting the free discharge of the matter.

## ABSCESS OF THE ANTRUM.

result from a blow, or the irritation of a decayed t ded with permanent, deep-seated aching of the en becoming intense, together with rigors and fe ursts, either internally or externally, which gives

The earlier that leeches and emollient poultices are applied, better; but, after the cavity has become filled with matter, there necessity for immediate puncture just over the third molar tooth; is tooth must be extracted, and a trocar pushed through the ket. The discharge of pus can be facilitated by syringing with m water.

### EPULIS.

is a solid tumour of the gum, of a non-inflammatory character. mmences in the form of a seed-like excrescence upon the gums, een the interstices of the teeth. Being without sensibility, it occasion but little inconvenience, except by its size. As it grows, ses its dense fibrous structure, and may become fungous; sometimes it becomes malignant.

*eatment.*—Nothing will suffice but complete extirpation of the sent portion of the gum and alveolar process. Several perfectly d teeth may have to be drawn, in order to apply a fine saw, or pliers. The hemorrhage is to be arrested by muriated tincon, and pressure by lint.

### PARULIS.

a gum-boil; occasioned usually by a decayed tooth, or a stump, tooth whose nervous pulp had been destroyed previous to plug-. The swelling is slow at first, though the pain is intense while us is forming. Unless the tooth is extracted, an opening will rmed through the alveolar process and gum, for the discharge e matter, which may remain fistulous.

e *treatment* will consist of leeches and fomentations, and the y evacuation of the abscess, either by the abstraction of a tooth, puncture.

### RANULA.

a sac formed beneath the tongue, by an expansion of Wharton's either from disease or obstruction. Inconvenience is felt in cation, deglutition, and articulation.

e *treatment* consists of dilatation of the duct, or making an ial opening. It is necessary to keep the orifice distended by a r loop of wire, until the cyst contracts to its normal size; wise it will be refilled.

## UNDS AND AFFECTIONS OF THE THROAT.

### INFLAMMATION OF THE TONSILS.

s is characterized by the rapid swelling of the part, great pain lutition, and fever. It is to be treated by bleeding, leeches,

, and gargles. An incision made with a bistoury will un-
; vessels, and give exit to any pus which may have been

*nic enlargement* of the tonsil may result from inflammation,
ly in scrofulous persons; deglutition is impeded, the voice
red hoarse, respiration is noisy and laborious, and there may
ıess, from the obstruction of the Eustachian tube.
*reatment* should consist of the internal and external use of
ıstringent gargles, and the application of nitrate of silver.
; means fail, it should be removed by the knife, or with an
ent constructed for the purpose, such as Physick's or Fahne-

## ELONGATED UVULA.

may be removed simply by a forceps and scissors.

## STRICTURE OF THE ŒSOPHAGUS.

esophagus may have a permanent or spasmodic stricture.
*modic stricture* comes on suddenly, generally at meals, and is
l with pain, and a choking sensation. It depends on a weak-
hysterical state of the system, or neuralgia. Tonics, anti-
lics, and alteratives are the means of cure, with proper
n to diet, and care to avoid swallowing food that is hot or
ctly masticated.
*anent stricture* is a narrowing produced by inflammation of
cous and cellular coats, which forms a firm ring generally
: to the cricoid cartilage. It is most frequent in females,
these symptoms: difficulty of swallowing, which gradually
s, and is never absent; pain in the chest and neck. It is a
complaint, and may be followed by ulceration, salivation,
g of purulent matter, and death from starvation or irrita-

*treatment* should consist of a mild course of mercury, com-
ith some anodyne, a seton between the shoulders, and the
of a bougie, together with a weak solution of nitrate of sil-
lied to the surface.

## FOREIGN BODIES IN THE ŒSOPHAGUS

ıce a sense of choking and suffocation, and may prove fatal.
*'ment.*—The patient should be seated in a chair, with his
rown back, and his mouth wide open; the surgeon should
troduce his finger, regardless of the attempts to v
position of the substance, and if possible remo
r by the assistance of curved forceps. A smal
a fish-bone, may be got rid of by swallowing

of bread; a large soft mass, such as a piece of meat, may be
hed down into the stomach with a probang; a rough and angular
ly, such as a piece of bone or glass, should be brought up, if
sible, by long and curved forceps, or with a piece of whalebone,
ed with a flat, blunt hook, or with a skein of thread, so as to
n a number of loops. If the stomach is full, it should be
tied by an emetic, with the hope that the foreign body may be
ted with the food. It may be necessary to resort to the opera-
of œsophagotomy, which should be performed by making an
sion as nearly opposite the foreign body as possible, through the
, platysma and fascia, and between the sterno-mastoid muscle
trachea. Care must be taken to avoid the carotid and thyroid
ies, and the recurrent nerve. A small opening should be made
e œsophagus, by cutting it upon a silver catheter, which should
assed down the throat, and made to project into the wound; the
ing should be dilated, so as to prevent hemorrhage.

### FOREIGN BODIES IN THE LARYNX AND TRACHEA.

ed may get into the rima glottidis, whilst a person is laughing
lking at a meal; and unless immediate relief is afforded,
will result. The surgeon may sometimes be enabled to re-
it with his finger; but if not, the larynx or trachea should be
d, and a probe introduced through the wound, so as to push
reign substance up into the mouth. A foreign body may be
ged in the ventricle of the larynx, or be loose in the trachea,
sing spasmodic cough, difficulty of breathing, and pain; a
body may even pass into the bronchial tube, generally the
one. Laryngotomy, or tracheotomy, may be necessary. The
x is opened by a longitudinal incision through the middle
thyroid ligament. The trachea is opened in the median line
gh the skin, fat, and fascia, at the lower portion of the neck.
the tracheal rings are made bare, the patient is directed to
w; and while the windpipe is thus rendered tense and elon-
the scalpel is made to penetrate the lower part of the wound,
ts back towards the sternum, and the rings are to be divided
ting upwards. Care should be taken, in this operation, to
opening large veins, or any part of the thyroid gland. This
ion is sometimes necessary for dyspnœa, when a conical curved
hould be introduced for the patient to breathe through.

## WOUNDS AND AFFECTIONS OF THE NECK.

### WOUNDS OF THE NECK.

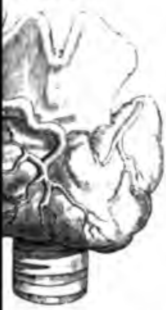
extremely dangerous, on account of the important parts in-
and are usually the results of attempted suicide.
treatment consists in arresting hemorrhage, obviating diffi-

of breathing, and preventing inflammation. The arteries must pidly yet carefully tied, and the hemorrhage of the large veins ined by pressure. If the larynx or trachea should be wounded, quent inconvenience may result from the introduction of cold ots of blood, &c.; if the pharynx or œsophagus is wounded, se of a tube becomes necessary, in order to convey nourish- to the stomach. This tube must be introduced through the ı, and not through the wound, as often as it may be necessary pply the patient with food. The edges of the wound should be lly drawn together, and dressed in the most simple manner, hould be protected from unfavourable atmospheric influences covering of loose gauze, or of woollen texture thrown lightly he neck. The patient should be carefully watched, to prevent rrence of the injury. A fistulous opening sometimes remains trachea or larynx, which is extremely difficult to heal.

### BRONCHOCELE, OR GOITRE.

ı swelling of the thyroid gland, depending, for the most part, hypertrophy, although a cyst may be formed, or calcareous matter deposited. In certain localities, it is an endemic disorder, and often associated with cretinism. It occurs most frequently in females after the age of puberty. It grows gradually, and without pain, occasioning inconvenience merely by its deformity and bulk. Respiration is sometimes affected, and the venous blood being prevented from returning from the head produces cerebral disorder. The cause of the disease is obscure, but probably connected with climate.

Fig. 19.



The *treatment* will consist in the use of iodine, internally and externally, with attention to the general health; or it may be sary, under the threatening of suffocation, to perform an opera- The removal of the gland is extremely dangerous, on account norrhage, and does not always produce a cure.

### TORTICOLLIS, OR WRYNECK.

is is a distortion of the neck to one side, generally the result asm of the sterno-cleido-mastoid muscle, or by a paralysis of nuscle of the opposite side. It may also result from tumours, of the spine, and cicatrices, especially those from burns.

e treatment will vary with the causes producing it. If it re- from spasm, purgatives, leeches and fomentations should be if from paralysis of the opposite side, general tonic treatment and stimulating friction will be useful. If the contraction be permanent, the muscle must be divided.

## INJURIES AND SURGICAL AFFECTIONS OF THE CHEST.

*Wounds* of the chest may be inflicted by a sharp instrument, a fractured rib, or a bullet. Danger results from hemorrhage, and subsequent inflammation from air, or clot of blood in the pleura. The intercostal may be the source of the bleeding, and it is sometimes difficult to arrest it by the ordinary means. A curved needle, armed with a ligature, is the best means of securing the vessel, when deeply concealed in the intercostal groove. The entrance of air into the chest (pneumothorax) through the wound is to be prevented as much as possible by the early and accurate closure of the wound; otherwise there may be compression of the lung. The suppuration of the wound may lead to inflammation and suppuration of the pleura. This collection of pus in the chest is called empyema.

When the lung is wounded, there is still greater danger from hemorrhage, inflammation, and the air. It is attended with great prostration, difficult breathing, anxiety of countenance, and expectoration of blood. The danger of bleeding results not only from the direct loss, but from its collecting in the pleura (hæmatothorax), and its filling up the bronchial tubes and trachea. The inflammation may subsequently destroy the lung, and the life of the patient also by hectic. The air may also more readily enter the cavity of the chest, and not being readily discharged through the external wound, may infiltrate into the subcutaneous cellular tissue.

The hemorrhage is to be controlled by venesection, rest, and other antiphlogistic means. A careful examination of the wound should be made, in order that no foreign matters remain; the patient should lie on the wounded side, so as to favour the discharge of blood or pus, and it may also be necessary to prevent a closure of the wound. Emphysema may be overcome by compression, or an incision.

### PARACENTESIS THORACIS.

Puncture of the thorax, may be required for accumulated air, blood, or pus. The opening is most frequently for empyema. The point selected is usually between the sixth and seventh ribs, half way between the spine and sternum. If made too low, the diaphragm may be wounded; if too high, the fluid will not so readily escape. The opening should be closed with care, to avoid the entrance of air.

## WOUNDS OF THE ABDOMEN.

*unds of the abdomen* are extremely dangerous, on account of nportant viscera contained within, and the liability to perito- A simple wound of the parietes must be closed by suture if xtensive, care being taken not to include a portion of the in- e. When complicated with a wound of the liver, fatal hemor- must almost necessarily result, on account of the great vascu- of the organ. A patient may survive a small wound, which e succeeded by great prostration, pain in the liver, yellowness skin and urine, and a bilious discharge of the wound.

*wounds of the gall bladder, and spleen, and urinary bladder,* mmunicating with the peritoneum, are almost always fatal. ds of the *kidney* are also exceedingly dangerous from hemor- violent inflammation, and suppuration, with excessive vomit- Venesection, laxatives, warm bath, avoidance of drinks, with lressings of the wound, are the proper measures for treatment.

### PROTRUSION OF THE BOWEL.

en a portion of the intestine protrudes through a parietal of the abdomen, it is to be returned with great gentleness ccuracy, so as to avoid inflammation and obscure strangulation. dges of the wound are to be carefully approximated, by suture essary, and by moderate bandaging such pressure is to be as to prevent reprotrusion.

### WOUND OF THE BOWEL.

vound of the bowel may be suspected from the passage of with the stools, the escape of fæces through the wound, ex- ting pain over the whole belly, and a great tendency to col-

ravasation into the cavity of the peritoneum does not take from a small wound, owing to the protrusion of the mucous hrough the muscular, and the constant and equable pressure the abdominal viscera; lymph is also rapidly effused, and the uous edges are thus united. If, therefore, the protruded part nd to have sustained a mere puncture, it is to be returned as re. A small incision may be closed by the glover's suture; ds are cut short, and the exudation of lymph envelopes the , which in time finds its way into the cavity of the bowel, and nce discharged.

he portion of bowel be bruised and lacerated to such an extent ender adhesion impossible, and gangrene probable, the wounded nust be retained at the surface, and the peritoneal coat united he integuments at one or more points; the fæces are thus discharged through the external wound, and an *artifical anus* is thus established.

### WOUNDS OF THE STOMACH.

Are recognised by vomiting of blood, and the nature of the matters which may escape from the wound. They are much more dangerous than those of the bowel. The edges of the stomach and the edges of the external wound are to be stitched together by the continuous suture. The subsequent treatment should consist of perfect rest, and the prevention of inflammation; venesection and leeches, and large doses of opium, will probably be necessary; nothing but thin arrow-root, or mucilage, should be given as a diet, and it may be necessary to administer this by the rectum: purgatives should be studiously avoided.

### ARTIFICIAL ANUS.

This is an unnatural opening of the intestine, through which fæces are discharged. It may be the result of a wound, or sloughing consequent on strangulated hernia. The orifices of the upper and lower portion of the intestine are united with the abdominal wall. The lower portion of the bowel becomes contracted, and receives but little fæces. The integuments around the artificial opening form a funnel-shaped cavity, the edges of which are red, everted, and excoriated. The *consequences* of the affection may be inanition by the escape of chyle, especially if the upper portion of the small intestine be engaged; a patient is liable to hernia, colic, besides the disgusting annoyance of the constant escape of fæces and flatus.

The *treatment* will consist of regulating the bowels by diet and medicine, and by supporting the orifice by a compress or truss, which will retard the escape of the discharge, and promote the contraction and cicatrization of the funnel-shaped cavity. It may be necessary to perform Physick's operation: this consists of introducing a ligature by means of a curved needle into the orifice of the upper intestine, and bringing it out through the orifice of the lower, which ligature is then to be secured with a slip-knot. The object of this ligature is to produce adhesion between the peritoneal surfaces of the upper and lower intestine: this will require several weeks; afterwards, an opening is to be formed through this adhesion by means of a bistoury, through which the fæces will pass from the upper to the lower intestine, the external orifice being firmly compressed with a truss. Dupuytren operated by means of a forceps, one blade of which was inserted into the orifice of each intestine, and the pressure regulated by a screw at the handle. The effect of the pressure of the two blades of the forceps, is first to

) adhesion between the sides of the two intestines, and by
ater pressure, to form an opening between them by ulcera-

## HERNIA.

iia signifies a protrusion, but the term is usually limited to trusion of the abdominal viscera. The *predisposing* cause is aess of the parietes of the abdomen at the natural openings. akness may be increased by injury, disease, or pregnancy, re may also exist a congenital deficiency.

exciting causes are muscular exertion, jumping, straining, on wind instruments, coughing, vomiting, lifting weights, othes, parturition, straining at stool, &c. *Hernia is divided,* ng to the site of the protrusion, into *inguinal, ventro-ingui-* *nbilical, ventral, phrenic, perineal, vaginal, pudendal, thy-* , and *ischiatic.* The *condition* of hernia is also a ground of into *reducible, irreducible,* and *strangulated;* and if the s of the sac be intestine, it is called *enterocele,* if it contains m, it is called *epiplocele.* The sac is formed of peritoneum, different parts are called mouth, neck, and fundus.

### REDUCIBLE HERNIA.

*ptoms.*—A painful swelling suddenly forms at some part of ominal parietes, which is compressible and soft; it can be o disappear by pressure in the proper direction, and it isappears spontaneously. An *enterocele* is smooth, elastic, and r, retires suddenly, and with a gurgling noise. An *epiplo-* more irregular in its form, has a doughy feel, and retires without noise.

*tment.*—The treatment consists of reduction and retention. *ion* is effected by a manipulation termed *taxis,* the patient laced in a recumbent position, and the muscles of the abdomen ; gentle and steady pressure is made by the hand in the n of the descent. *Retention* is effected by continued and pressure over the site of the protrusion, by means of a truss. ints of a good truss are, a well-made elastic spring and a at can be accurately fitted. The spring is to be applied two below the crista of the ilium, and not above it, as is fre- done. Care must be taken to prevent excoriation, and also ery portion of intestine or omentum is r
s to its application. By constant and c
l cure may be effected in a child, but ra.

## IRREDUCIBLE HERNIA.

When the contents of the sac cannot be restored to the abdomen, the hernia is called irreducible. It may arise from adhesions between the sac and the intestine contained, or from membranous bands stretching across the sac; from great enlargement of the omentum or intestine, or contraction of the cavity of the abdomen. The patient usually suffers from flatulence, indigestion, and constipation, owing to the peristaltic movements of the bowels being partially interrupted.

The *treatment* consists in carefully regulating the bowels, avoiding any great exertions, and the wearing of a bag truss to support the tumour, and prevent further protrusion.

## STRANGULATED HERNIA.

This is an incarceration of the contents of the sac, with inflammation and an interruption to the passage of fæces and the circulation in the part. The inflammation is caused by the constriction, which may be the result of spasm, or sudden enlargement of the intestine by fæces or gas.

The *symptoms* are flatulence, constipation, pain in the part and abdomen, nausea and vomiting; sometimes the matter is stercoraceous. The countenance is pale and anxious, the skin cold and clammy, and the pulse, which was at first full, now becomes rapid and indistinct; gangrene has taken place, the pain subsides in the tumour, which feels doughy and crepitant upon being handled. The vomiting may cease, and the patient will appear more comfortable, although he is actually sinking. It may be that the integuments and coverings of the intestine may inflame and slough with the intestine; and, after a copious feculent discharge, the patient may recover by artificial anus.

When the tumour is small and recent, and the constriction tight, a few hours may produce death, if no relief is afforded; when the hernia is old and large, days may elapse.

Many of these symptoms may exist in other diseases, as in colic or ileus, but inquiry or examination should always be made as to hernia.

*Treatment.*—The great object is to relieve the strangulation. In the first place taxis should be resorted to, and an effort made to reduce the contents of the sac. In order to facilitate this object, bleeding, warm bath, purgatives, enemata, opium, and cold applications to the tumour will be found of use. A tobacco injection, made with ʒj to Oj of water, may be of use, but requires great caution in its use, on account of its prostrating effect. These remedies may so

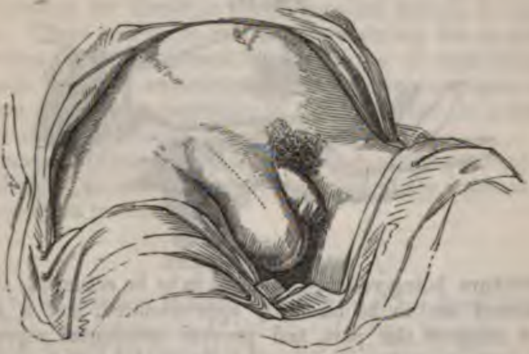
the system that the reduction can be effected ; at any rate they
minish the inflammation if judiciously used. If not successful,
ife must be used.

## INGUINAL HERNIA.

*bonocele* is a common name for this variety of hernia, which
ts of a tumour in the groin, made by a descent of the gut or
um through what are called the rings of the abdomen. These
e weak spots at which the protrusion takes place.
ore studying the operation for strangulated inguinal hernia,
be proper to examine the anatomy of the parts in their
l condition, and then the varieties of the disease.
*anatomy of inguinal hernia refer to Anatomy,* page 77.
*ique*, or *indirect* inguinal hernia, occurs thus:—The intestine,
entum, first pressing against the parietal peritoneum, distends it
rms it into a sac; this sac, containing the intestine, then presses
t the fascia transversalis at that portion where it is thin, and
from the abdomen to the cord, which spot is called the in-
abdominal ring, although it is not a hole. The sac, covered
fascia transversalis, which is now thickened by pressure,
lescends the inguinal canal, behind the transversalis and in-
oblique muscles, and when it reaches the external ring it
ered by the cremaster, which may be considered as a con-
ion of these muscles; thus covered, it escapes at the external
and there receives an investment from the intercolumnar super-
fascia and the skin. We thus see that the intestine is covered
epresentation of all the structures forming the parietes of the
nen, with the exception of the external oblique muscle.
*rect*, or *ventro-inguinal hernia,* is a protrusion at the external
ninal ring, having its coverings formed in very much the same
er as the last, but instead of the cremaster muscle forming a
ng, it is covered by the expanded tendon of the internal ob-
and transversalis muscles. Sometimes this tendon is split,
here is no covering representing this portion of the parietes of
bdomen. The tumour in this variety is nearer the symphysis
, and is on the inner side of the epigastric artery, whereas, in
direct variety, the tumour is on the outer side of the epigastric
.
*ncealed inguinal hernia* is a term applied to a protrusion which
een detained in the inguinal canal.
e *operation* for relieving the stricture in an indirect inguinal
a is to be performed by placing the patient upon the edge of a
with each foot resting upon a chair; the surgeon sits before
and makes an incision extending from the upper part of the
ur nearly to its base. The skin having been divided, the super-
fascia must next be divided. This will be found to exist in the

form of laminæ, the most inferior of which is the thickest; having been, in the natural condition of the parts, that portion of the fascia which fills up the space between the columns of the external ring, and which is sometimes called the intercolumnar fascia. After this division the cremaster muscle will be exposed, altered from its natural appearance; the fibres being stretched and separated from each other, and being more pallid than natural. Having divided these fibres, the next covering will be the fascia transversalis, which is continued from the abdomen upon the cord; this being done the hernial sac is then exposed.

Fig. 20.

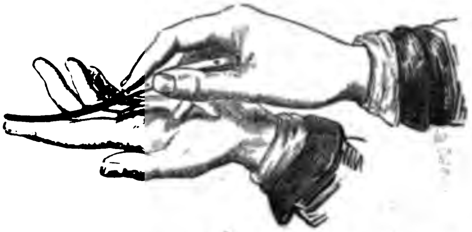


The sac being formed of peritoneum, has been mistaken by some for the intestine, from which it is to be distinguished by not having a flexure, or crease, which the intestine always has. The sac is to be opened carefully, pinching up a part and rubbing it between the fingers, in order that no portion of intestine may be included; a small opening is to be made, and into this a director may be introduced and the sac divided freely.

Bloody serum will escape freely, and the contents of the sac be thus exposed; the convolution, or knuckle of intestine will vary in its colour, according to the period and intensity of its strangulation, between a light red and a deep chocolate colour; very often the intestine will exhibit patches upon its surface when the inflammation has been intense. The finger is then to be introduced to examine the point of stricture; if none should exist, an attempt at reduction should be made, if the intestine be in a proper condition. The stricture having been detected, a probe-pointed bistoury, with a cutting edge only near the extremity, is introduced flat upon the finger, and a slight cut made directly upwards to the extent of one or two lines. The only danger to be apprehended is the wounding of the

ic artery, and this is avoided by making a vertical, instead
ral incision. The sac may be strictured by the external or
ring, or in the canal by the lower edge of the transversalis

Fig. 21.



tricture being relieved, the gut is to be returned, the edges
wound are to be carefully approximated, and a compress
to support the part, and prevent accidental reprotrusion.
laxative may be given in a few hours if there is no peristaltic
of the bowels; sometimes the bowel seems to have been pa-
by the compression, and its peristaltic action is not recovered
ral hours. Danger results then from the accumulation of
es, food, &c., and life may be lost by inflammation of the
ubsequent to its reduction. The antiphlogistic treatment
most serviceable. After cicatrization a truss must be worn
nt a return of the protrusion, though occasionally the opera-
duces a radical cure. Such is the course of an ordinary
ut it may be found upon opening the sac, that the hernia is
ble, owing to the intestine adhering to the sac; the stricture
relieved, and the wound dressed, and no attempt made to
he intestine, unless the adhesion be recent or slight.

d the intestine be extensively mortified it is not to be re-
the only chance of life being through the establishment of
cial anus; but if mortified only in a few spots, the spots are
cluded with a fine ligature, and the intestine returned; the
finds its way into the interior of the gut, and is discharged
fæces.

se there should be a gangrenous condition of the omentum,
grenous part should be cut off, and the vessels secured by
tures; the remainder may then be returned to the abdomen,
lowed to remain impacted in the outlet, and thu
endency to protrusion.

have successfully divided the stricture exteriorly
being reduced with the hernia. The objection to

tion is the danger of there being a stricture within the sac; and if the gut should be gangrenous it will not be discovered.

Usually the cord will be found behind the sac, but sometimes it is split up, and its constituents found lying upon the sac; caution is then required to avoid wounding the artery and duct.

The operation for direct or ventro-inguinal hernia, is very much the same. There will be no cremasteric covering, but in place of it an expansion of the conjoined tendon of the internal oblique and transversalis muscles; sometimes this is wanting, owing to the tendon having been split, especially if the protrusion is sudden, and the result of great violence.

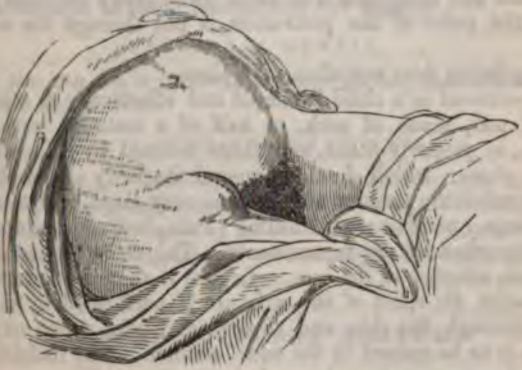
In a concealed inguinal hernia, the tendon of the external oblique must be divided, as well as the lower portion of the internal oblique and transversalis muscles.

## FEMORAL HERNIA.

This is most common in women, owing to the natural form of the pelvis. The descent occurs at the *crural* ring; in order to understand which, it will be necessary to refer to the *anatomy of the part.* (See Anatomy, page 92.)

The tumour is more spheroidal usually than in inguinal hernia, and will be found to be beneath Poupart's ligament, instead of above. The fundus of the tumour is bent upon its neck, which curvature must be attended to in producing taxis. Strangulation is more common and more severe than in inguinal hernia.

Fig. 22.



The operation for the relief of stricture is thus performed. The patient being properly placed upon a table, and the parts being shaved, in is pinched up and divided by transfixion, in order that there e no injury to the important parts beneath. The wound of in may be crucial in shape, or resemble an inverted T.

er dividing the skin, the superficial fascia is exposed; this divided, the fascia propria is brought in view; that fascia is mes much blended with the sheath of the vessels. Under the propria will be found the hernial sac. It is opened in the same us manner as before, when a smaller quantity of fluid will than in inguinal hernia, and the convolution of intestine be recognised. The seat of stricture is then to be sought; it e at Hey's ligament, at Gimbernat's ligament, or at the mouth sac. The stricture is to be divided with great care, for fear irregular origin of the obturator artery, the neck of the sac surrounded by it.

gut being returned, the after treatment will be the same as uinal hernia: the patient is to be kept in a recumbent position, nder antiphlogistic regimen. If there is no movement of the in the course of several hours, a dose of castor oil may be or a mild enema may be useful; should there be inflamma- ymptoms, leeches, calomel, and opium will be serviceable. onally the patient is troubled with tympanites and flatulence, will be relieved by a carminative, or enema of turpentine.

## UMBILICAL HERNIA.

s is common in infants in whom the umbilicus is not consoli- It is produced by crying; and appears as a soft, compressi- mour.

ccurs also in women who have borne many children; though m the point of the protrusion is not through the navel, but t.

ngulation does not often take place.

*treatment* in a child is simple and effective. A small hemi- cal pad, made of cork, or half of a nutmeg, covered with kin, is properly fitted, and there secured by a broad strip of ve plaster, which should surround the belly of the child.

he *adult* the tumour may become very large, and usually con- a large quantity of omentum. Pain, indigestion, and consti- are often its accompaniments. The *treatment* consists of a truss, adapted to the case. In case it should be strangulated, eration for relief of the stricture is performed by making an n through the skin and superficial fascia, which exposes the his is to be opened in the usual manner. The incision for the of the stricture is to be made in the linea alba.

## OTHER VARIETIES OF HERNIA.

### SCROTAL HERNIA.

Is a term applied to the protrusion of intestine when it has descended from the groin into the scrotum. It occasionally entirely obscures the penis, and reaches almost to the knees. Its coverings are those of inguinal hernia.

### CONGENITAL HERNIA.

This depends upon a want of obliteration of the connexion between the peritoneum and tunica vaginalis of the testicle. The intestine descends in the same manner as the testicle. It has no sac or peritoneal covering other than that in which it and the testicle are contained.

This is most common in young male children, and is easily cured by a truss; there being a natural tendency to closure in this tubular connexion between the peritoneum and tunica vaginalis. Care should be taken in the application of the truss or compress, not to injure the spermatic cord.

In very young children a graduated compress and roller will effect a cure if properly applied.

### VENTRAL HERNIA.

Is a protrusion of the intestine at any part of the belly except the navel and groin; and it may be the result of a bruise, wounds, and unnatural weakness of the muscles of the abdomen.

### VAGINAL HERNIA.

Is a protrusion of the intestine into the vagina.

### PERINEAL HERNIA.

When the tumour is in the perineum, having descended between the bladder and rectum.

### PHRENIC OR DIAPHRAGMATIC HERNIA.

Is a protrusion through an opening of the diaphragm.

The intestine is sometimes strangulated within the cavity of the abdomen, through an opening in the mesentery, or meso-colon, or some portion of peritoneum, or peritoneal band, resulting from inflammation.

## DISEASES OF THE RECTUM.

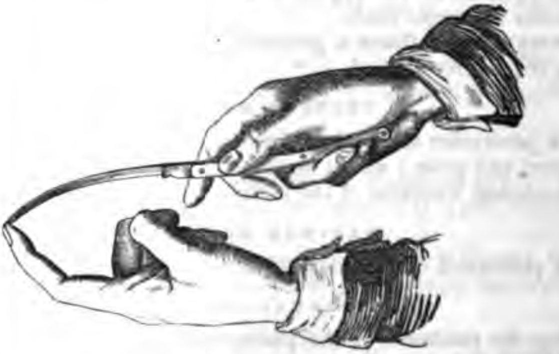
### FISTULA IN ANO.

A *Fistula* is said to be *complete* when a sinus communicating with wel, opens upon the nates; when it does not communicate he bowel, but opens externally, it is called a blind external ; when it opens internally but not externally, it is called a nternal fistula.

omplete, there is discharge of pus, fæces, and wind, and it is ed with heat, uneasiness, and pain. The sinus is sometimes ortuous, and often multilocular. The internal orifice is usually an inch and a half above the anus, but sometimes higher. ause producing it may vary. It may originate in an inflam- of the rectum, or by an abscess external to it. It is very ntly connected with phthisis caused by the constant cough in isease.

*treatment* for complete fistula is generally that of the knife, ject being to place the part at rest, and convert the sinus into n sore. The bowels having been entirely emptied, the index of one hand being oiled, is introduced into the rectum, and a

Fig. 23.



pointed bistoury is introduced through the sinus into the gut, its probe touches the finger; thus kept in contact, both finger stoury are withdrawn, completely laying open the sinus, and g the sphincter ani muscle. Any bleeding vessel is to be hemorrhage by oozing is to be stopped by stuffing with lint; l portion of lint is to be placed between the lips of the wound, o prevent their closure; the object being to make the whole inflame, granulate, and heal from the bottom. After the ion, a dose of morphia may be given to promote quietness and and after three or four days a dose of castor oil, which will away the contents of the bowel, and the dressings of the . Subsequently it will only be necessary to attend to clean- and prevent the edges from uniting.

he opening be very high in the rectum, it is better to use the ligature in preference to the knife, on account of the danger of hemorrhage from the hemorrhoidal arteries. The ligature only is to be used in phthisical cases; it gradually cuts itself out, and leaves the part solid behind it. A blind fistula may be readily converted into a complete one by puncturing the intestine should it be an external fistula, or the skin in case it should be an internal one.

### FISSURE OF THE ANUS.

This is an ulceration or cracking of the skin and mucous membrane, on the verge of the anus; and is attended with intense pain, especially upon going to stool. It results very often from dyspepsia, and this circumstance must materially affect the treatment. Alteratives and laxatives are necessary to bring the bowels into a healthy condition. The local applications are caustics and anodynes, such as nitrate of silver, which has a soothing as well as antiphlogistic power; opium, in the various forms of ointment, solution, and poultice. Sometimes it is necessary to excise the part, or divide the sphincter ani muscle.

### HEMORRHOIDS.

Piles, or hemorrhoids, are divided into external and internal. They are more common in males than in females, and rarely occur in children. The predisposing causes are whatever tends to determine the blood to the rectum, such as constipation, pregnancy, sedentary habits; and the exciting causes may be purging, diarrhœa, &c.

#### EXTERNAL PILES.

Are a congeries of varicose veins, surrounded by condensed cellular tissue. In some cases, bleeding occurs from ulceration of the skin or mucous membrane covering them. When they do not bleed, they are said to be blind. When the blood has coagulated, they become hard. Usually, there is more than one.

The *palliative treatment* consists in the application of astringent and anodyne ointments, made of galls, opium, &c., and the regulation of the bowels with laxatives, such as sulphur, rye-mush with molasses, &c.

The *radical treatment* is removal by scissors or bistoury; arresting the hemorrhage, and producing a healthy ulcer. A recent tense, single pile, may be successfully cured sometimes by freely evacuating its contents by a lancet.

#### INTERNAL PILES.

May be of the same nature as external ones, or of a sarcomatous character; but more frequently they consist of an abnormal develop-

f the submucous cellular tissue, having the nature of erectile
the tumour has a broad base, and its surface resembles a
rry; at stool they protrude, and are attended with hemor-

The general health will suffer by emaciation, indigestion,
nd there may result fistula, prolapsus, and disease of the
organs.

*tment.*—In the first place, the stomach and bowels must be
ed by laxatives;—disorder of the liver must also be cor-
since any obstruction of the portal circulation in that organ
oses to hemorrhages, or congestion of all the chylopoietic
; there being no valves in the veins forming the portal vein.
enefit will result from the use of astringent injections, such
tions of zinc, oak bark, &c.; but the radical cure consists in
oval of them, by strangulating with a ligature or wire ap-
y means of a double canula.

should not always be cured in elderly persons, especially
ith tendency to diseases of the head.

### PROLAPSUS ANI.

is an eversion and protrusion of the rectum beyond the
nd is dependent upon relaxation.

extent of the protrusion varies much in different cases;
instances being confined to a small portion of the mucous
ane; in others, the rectum, and perhaps a portion of the
flexure escape. In children, worms, diarrhœa, straining,
ing, may promote the disease. In old persons, it is brought
nlarged prostate, stone, coughing, &c. When the gut habi-
lescends, the tumour is red and large.

*treatment* consists in removing the cause; in regulating the
and carefully replacing the intestine after each protrusion.
cuations should be made in the recumbent position.

general habit should be invigorated by tonics, and the tumour
be bathed with cold astringent washes. It may be necessary
icate the parts before reducing them, and afterwards a T
should be worn, to prevent the prolapse.

xtreme cases, operations have been performed. A fold of the
membrane has been removed, in order to contract the in-
; and a portion of the sphincter has been cut out, in order
nish the orifice of the anus.

### ENCYSTED RECTUM.

consists of an enlarged and diseased condition of the sacs of
cous membrane of the rectum, just above the anus.

treatment consists in drawing down the sacs with a bent
and excising them with a pair of scissors.

## IMPERFORATE ANUS.

is is a congenital imperfection. The rectum terminates in a sac, at various distances from the ordinary location of the in some instances, it is so near the skin as to form a promi- , by the constant collection of fæces. In such cases, the opera- s easy and simple: a free opening being made in the proper ion, with regard to the bladder or vagina, the meconium escapes, he edges are prevented from uniting, by the interposition of a of lint. In other instances, it is impossible to reach the cul ; then it is necessary to form an artificial anus. This is done ning the descending colon immediately under the left kidney, g the incision through the skin and fascia, so as to expose the ior portion of the bowel, which is not covered by peritoneum s part; a sphincter is said to be formed in the loins, though ecessary to wear a pad.

## URINARY CALCULUS.

uli are generally formed in the kidneys by a precipitation of substances, and when they pass freely and frequently, the is termed *gravel;* when they are retained and become large, ease is called *stone.*

symptoms of stone in the kidneys are pain in the lions, irri- and retraction of the testicle, bloody urine, and inflammation kidney. The passage of the stone through the ureter causes cute and severe pain in the loins and groin, faintness, and s of stomach, which may last for several days, and is only l by the stone entering the bladder.

treatment for a *fit of the gravel,* as these attacks are called, in bleeding, warm bath, large doses of opium, soothing , diluent and diuretic drinks, spirits of turpentine, &c. inary result is the passage of the calculus; but sometimes tained in the kidney, increasing in size, and assuming the g form of the pelvis, calices, and infundibula. It does ays produce inconvenience, but generally is attended with of the organ, or suppuration, the abscess bursting into the loins.

all calculus, lodging in the bladder, and not being dis- through the urethra, serves as a nucleus for further deposit; ign body, such as a needle, drop of blood, or bullet, may go, as a nucleus. The symptoms of stone in the bladder uent, sudden, irresistible, unrelieved desire to make water; the glans penis, and elongation of the prepuce; sudden of the stream in urination, and its re-establishment by f position—the urine being mixed with mucus and some- h blood; but nothing but a sound can positively prove its

ce. Many of the symptoms are simulated by other diseases,
s stricture of the urethra, enlarged prostate, irritable blad-
. The rectum sympathizes, especially in children, and he-
ids or prolapsus ani are apt to occur. Stones vary in their
ize, colour, consistence, and chemical composition; some are
n their surface, others smooth; they are more frequently of
shape. The size may be that of a pea, or that of a goose-
The most common colour is a light brown; some, however,
rly white, others nearly black. Some are soft and friable,
mble easily; others are flinty, and require great force to
them.

are most generally composed of lithic or uric acid, lithate
onia, phosphate of lime and magnesia, oxalate of lime, and
te of lime. The lithic acid stones are perhaps the most
n: they are oval, flattened, of a fawn-colour, and consist of
ric laminæ; the phosphatic stones are high-coloured and
The oxalate of lime forms the mulberry calculus, which is
dest stone, of a very dark colour and a very rough surface.
mber existing in the bladder at once, may vary from one to
hundred.

formation of stone is consequent upon a derangement of
deficiency of exercise, indulgence in animal food, defective
n of the skin, and dyspepsia. It is also dependent upon
, age, locality, and hereditary influences. The immediate
n every case cannot be discovered; some suppose that the
er of the water drank influences its production. Stones are
nes encysted in the prostate gland and urethra.

*tment.*—Gravel may be prevented or mitigated by attention
skin and digestion, the use of acids or alkalies, dependent
e diathesis of the patient manifesting the disease; but, after
s been lodged in the bladder, it cannot be removed by medi-
surgical means must be resorted to.

*ding.*—This requires great tact and care in its performance,
st only be attempted when the condition of the patient is
vourable; if performed immediately after a journey, or dur-
t of the gravel, the consequences might be serious. A sound
d steel instrument, resembling a catheter in shape, but hav-
curvature much nearer the extremity, and a broad flattened
The patient should be placed in a recumbent position, and
e retained in the bladder for some time previous to sounding.
strument being carefully introduced, can be moved about in
dder, and when the stone is touched, a distinct click will be
and a sensible impression of impingement will be felt.
re many sources of error in sounding: the instrument may
er the stone, when lodged in the inferior fundus of the
, or the stone may be small and encysted in the mucous
n the other hand, we may be deceived by the sound grating

and Lithotripsy.

### LITHOTOMY.

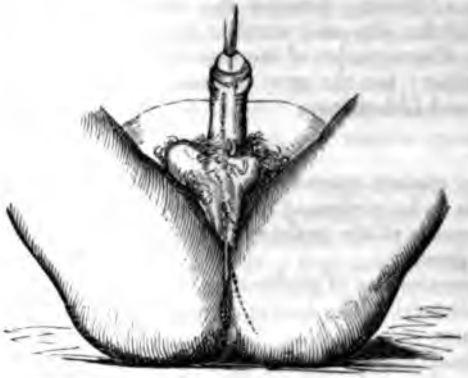
n ancient operation, modified and improved in modern is to be performed in children and in old persons, when onsists of the oxalate of lime, and when there is stricture, prostate.

rent modes of performing the operation are the lateral, ilateral. The lateral is most common, and is performed ner.

ent, having been properly prepared by emptying the etaining the urine in the bladder, is placed upon a table nt height, and firmly bandaged hand to foot, with his ted. A staff as large as the urethra will admit, and oved on the convex and left side, is then introduced. nts separate the knees, so as to expose the perineum, nt to be cleanly shaved. The patient is then to be the edge of the table, and the surgeon seats himself in his instruments in good order, and conveniently at hand. eing brought in contact with the stone, is well hooked e symphysis pubis, and not pressed down upon the rec- ien given to a third assistant, who is directed to hold it and also charged with keeping the scrotum out of the

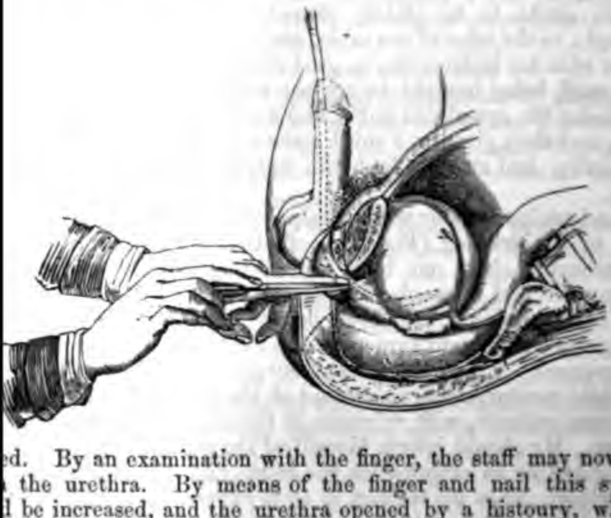
on is made with a scalpel in the direction of the dotted drawing (Fig. 24), of about three inches in length, g about one inch behind the scrotum, and extending and outwards to a point between the anus and tubero- ischium, and even beyond it. Various measurements y different surgeons as to the point at which this is to be in and superficial fascia of the perineum, which is very thick, lly in fat persons, the transversus perinei muscle, the trans-

Fig. 24.



perinei artery, the lower edge of the triangular ligament, may be a few fibres of the levator ani muscle, must then be

Fig. 25.



d. By an examination with the finger, the staff may now be the urethra. By means of the finger and nail this space l be increased, and the urethra opened by a histoury, which e indicated by a flow of urine. The gorget should now be luced into the wound, with its beak securely fixed in the e; it is then pushed in the direction of the bladder, cutting through its neck and prostate gland. Care must be taken to depress the handle of the gorget whilst making this thrust, for fear of wounding the rectum. Urine gushes out, the gorget is carefully removed, for fear of wounding the internal pudic artery, and the finger introduced into the bladder to discover the stone, its position, and size. A strong pair of forceps are then introduced, and the stone grasped in such a way that its short diameter shall engage in the wound, whence it is to be delivered slowly and gradually.

If it be impossible to remove the stone through this opening, it may be enlarged with care, on the same, or, if necessary, the other side. After its removal, the finger must again be introduced, to see if there is another stone.

The bladder being freed from all calculus by the forceps or syringe, a tube is introduced into the bladder through the wound, by which the urine is to escape. The patient is then put to bed, with the knees placed together. A small cup or saucer receives the urine from the tube. Severe hemorrhage may result from a wound of the bulb of the corpus spongiosum, or from cutting the urethro-bulbar artery. If a ligature cannot be applied, it must be compressed by the finger as long as may be necessary.

There may also be a venous or arterial oozing, which is to be arrested by removing the tube and cramming the wound with lint, a catheter being introduced through the urethra. Should there be no hemorrhage, the tube is to remain until the wound has granulated around it, and the urine has commenced to flow from the urethra.

Some prefer to open the bladder with a scalpel, having confidence in their anatomical knowledge, and considering the gorget as a clumsy instrument, a remnant of olden times. Others use a concealed bistoury, cutting either upon one or both sides of the urethra. Besides which are various instruments, modifications of the gorget, and scalpels with beaks attached.

In four or five weeks the wound is healed.

The *high operation* is performed by making an incision through the linea alba, opening the bladder where it is not covered by peritoneum. This is only necessary where the stone is of enormous size, the prostate diseased, or the space between the tuberosities of the ischia contracted.

*Stone in women*, is much less frequent than in men, because the renal calculus is more readily passed by the urethra. Should it be retained, and increase in size, it may be removed by dilating the urethra sufficiently, or by the lateral operation, making the incision from the orifice of the urethra, and through the neck of the bladder. Incontinence of urine is apt to follow.

The *recto-vesical* operation consists in cutting into the bladder from the rectum.

## LITHOTRITY.

›trity signifies the boring or drilling the stone, and has been ıccessfully accomplished by Civiale. His instrument con- a straight canula containing a drill and three claws which protruded after its introduction into the bladder. These re equally liable to catch the coats of the bladder as well as ıe, and the operation has been superseded by the following.

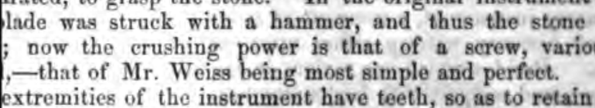
## LITHOTRIPSY.

implies the *crushing* of the stone whilst in the bladder; and ferred to all other operations for disintegration.

ases most favourable for this operation are adults, where the is free from stricture, the bladder free from irritability and tracted, and the prostate not enlarged. A mulberry calculus be unfavourable for lithotripsy, on account of its hard cha-

instrument most frequently used is that of Heurteloup, or a ation of it. It consists of two blades, which slide one upon

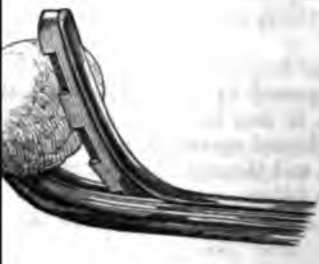
Fig. 26.



er, the extremities being slightly bent. It can be introduced e bladder as a sound or catheter, and afterwards the blades ırated, to grasp the stone. In the original instrument the lade was struck with a hammer, and thus the stone was ; now the crushing power is that of a screw, variously ,—that of Mr. Weiss being most simple and perfect.

extremities of the instrument have teeth, so as to retain the stone when grasped, and also fenestræ to allow of the escape of sand or powdered stone.

Fig. 27.



The patient must be previously prepared for the operation, by regulation of the general health, dilatation of the urethra, and distension of the bladder. The patient lies on a convenient table or bed, with the pelvis elevated, so as to throw the stone into the

lus of the bladder; the bladder must be full, so as to prevent
oats from being entangled in the instrument. If urine cannot
retained, tepid water must be injected. The instrument must
iled and warm.

fter encountering the stone and fairly grasping it, an operation
h requires tact in manipulation, the stone is crushed by slowly
gradually turning the screw. Then the instrument should be
drawn, and when the irritation has subsided, subsequently in-
uced to crush the fragments. Thus many operations may be
ired to reduce the stone into fragments sufficiently small to pass
irethra.

is not to be expected that fragments will escape at the first
tion: the after treatment should consist of diluent drinks, and
l injections to accelerate their passage; and it may be that the
ath, anodyne enemata, and leeches, will be required. The
es of danger are the irritability of the bladder, and urethra;
mation often resulting from the irregularity of the fragments,
oo frequent introduction of the instrument. Sometimes frag-
are arrested in their passage through the urethra: a bougie
theter should be introduced, of large size, and the fragment
d back into the bladder: should it become impacted it may
e a special instrument for its extraction, or an incision in the
um.

*obson's* instrument is used by many. Its extremities are con-
l by a link: thus a loop is formed to grasp the stone when
ades are separated in the bladder. By the operation of the
the female blade is pulled upon the male; whereas in Heurte-
the male is pushed upon the female,—thus there is less dan-
fine fragments or sand being caught between the blades of
ter, which would impede the movement.

## VENEREAL DISEASE.

history of this disease is involved in some obscurity, although
nerally believed to have existed from the earliest ages. It
s of *Gonorrhœa* and *Syphilis*, which are usually considered
inct diseases, although there are high authorities to the con-

### GONORRHŒA.

orrhœa is an acute inflammation of the lining membrane of
thra, commencing in its anterior portion. It is caused by
from another, during sexual intercourse. In about five days
arge appears, although it may occur in a few hours, or not
n days after coition.

*ptoms.*—Heat, itching, redness of the glans, and swelling of
ps of the urethra; the stream of urine is small and attended

ning and smarting; the swelling, redness, and pain increase;
harge is no longer limpid, but turbid, puriform, and pro-
metimes being mixed with blood; the thighs, loins, testi-
l groins sympathize in a dull pain, and there may be fever.
may occur, which is an intensely painful erection of the
hich is bent like a bow, with the convexity upwards: this
to the corpus spongiosum being filled with lymph, which
its expansion by blood. It is aggravated by the warmth
ed, and voluptuous dreams.

lans may become excoriated; the prepuce œdematous, in-
hymosis; a sympathetic bubo may form in the groin, or an
in the perineum.

oints may be painful as in rheumatism; the testicle swell
me, constituting orchitis, especially if the patient is impru-
exercise, during which the discharge diminishes. As the
declines, the discharge reappears.

rhœa is capable of self-cure; the symptoms gradually sub-
nd the discharge diminishing, and becoming mucous in its
r: it is then a *gleet*, which is without pain, redness, &c.,
h is readily rekindled into an inflammatory gonorrhœa by
nce in diet or exercise.

*ment.*—In the earliest stage, the ectrotic or abortive plan
pursued, if the discharge has not reached the suppurative
A strong solution of nitrate of silver, used properly with a
inge, may cut short the disease at the outset. It should be
t once or twice, and acts by neutralizing the virus, as an
gistic, and also coats the urethra with a film which protects
us surface. This treatment often fails, especially in irritable
ments, and when not used in the earliest stage; and if not
ng, is followed by an aggravation of symptoms.

*treatment* of gonorrhœa, it is to be remembered that the
ck is generally the most severe; hence the importance of
ch is seldom complied with. Low diet, purging, and tartar
s an antiphlogistic and antaphrodisiac; opium and cam-
also useful at night, in preventing painful erections and
; a warm bath is most serviceable. Mucilaginous drinks
igate the ardor urinæ. Leeches and ice to the perineum
times very advantageous.

ischarge now must not be suddenly arrested, else by meta-
e testicle, bladder, or prostate become involved. Strong
s are very injurious, although they may temporarily arrest
harge. As the inflammatory symptoms subside, weak
nt injections may be used with a glass syringe: sulphate of
zinc, alum, or iron, in the proportion of half a grain to the
water.

*s* and *copaiba* are remedies which seem to exert a specific influence on the urethra: the latter may be given in almost all stages of the disease; but the former should be restricted in its administration to the latter stage. These medicines often do harm, when persevered in too long, by inducing a chronic disease of the bladder, attended by a slight discharge. In the chronic stage of the disease, the discharge may be benefitted by weak solutions of nitrate of silver, and a weak solution of chloride of zinc. In a gleet, a large bougie introduced into the urethra, will often prove of immediate service.

Spurious gonorrhœa, or balanitis, is a discharge from the prepuce and glans, often induced by want of cleanliness, or gonorrhœal matter. A solution of nitrate of silver, and frequent application of cold water will cure it.

*Warts* are to be removed by the scissors or knife, and their bases touched with nitrate of silver, or nitric acid.

*Women* suffer less than men, although the vagina is involved as well as the urethra. The symptoms are the discharge, swelling, pain in micturition, sitting, and walking, aching in the back and loins.

The treatment is upon the same principles as in men; stronger injections may be used without the danger of stricture; and lint saturated with medicated solutions, retained in the vagina. Young girls suffer from spurious gonorrhœa and leucorrhœa, from which they are to be carefully distinguished. Leucorrhœa is chronic in its character from the first, attended with lassitude, pain in the back, pallor, irregular menstruation, and the urethra is not involved generally.

## SYPHILIS.

This term comprises all diseases resulting from a certain virus.

*Primary Symptoms.*—After one or two days' incubation of the virus, the pustule forms, and the ulcer is established at the sixth day. It is first attended with redness, itching, and heat; then a vesicle appears, becomes purulent, breaks, and an ulcer is formed. This is circular or oval, excavated, and pale, with a bright red areola; the discharge is thin, ichorous, and infectious; finally, flabby granulations and cicatrization. If the virus touches an abrasion, the sore may appear at once. This sore is not to be mistaken for a common ulcer, or abrasion, or herpes. Most frequently it is situated on the collum behind the corona; the most unfavourable position is the frænum, which it often destroys.

*Treatment.*—If the ulcer is freely cauterized before the sixth day, the poison is destroyed, the ulcer converted into a simple one, and the system is uncontaminated. After the application of nitrate of silver, water may be used, or water medicated with aromatic wine,

›ride of soda: granulation and cicatrization are treated as in her case, and thus a simple venereal ulcer heals.

### HUNTERIAN OR TRUE CHANCRE.

sore is circular, much excavated, with hardened base and and the surface is of a tawny or brownish hue, covered by pellicle. It occurs most frequently on the glans penis or the nd is usually solitary, and has no areola.

to be *treated* by the application of lunar caustic, and the in- administration of mercury and iodide of potash. Mercury s the cure of the primary sore, and affords security against ary consequences, especially of the Hunterian chancre; some l constitutional treatment may also be necessary. Blue pill given every night and morning, until the gums are slightly nd there is a slight increase of saliva: its action should be ined at this point for several weeks.

### PHAGEDENIC CHANCRE.

is rapid in its progress and painful; the surface yellow, otted with red streaks; the shape irregular; edges ragged ndermined; their discharge is thin, profuse, and sanious. ulcers eat deeply into the skin of the penis and surrounding This chancre is apt to occur in those whose constitution is down with drink, debauchery, prostitution, and mercury; ry usually aggravates it.

*atment.*—As a local application, the nitrate of mercury is eneficial; the chloride of zinc is also calculated to arrest the of the disease. The constitution must be supported with stimulants, and good diet.

### BUBO.

o is an inflamed lymphatic vessel or gland leading from a al ulcer; the glands may inflame from a wound of the foot n gonorrhœa, but a real syphilitic bubo is the result of ab- virus. Buboes vary in the rapidity of their develpment, and re termed acute, others chronic; the former hastening to sup- on, whilst the latter are indolent. If one gland only is affected, at above Poupart's ligament, it is most probably caused by e, if one exist; but if many glands are swelled, and they are this ligament, their swelling is probably the result of irrita- Inoculation is the surest test.

*atment.*—An acute bubo will often yield to rest, leeches, ations, &c., but if the venereal virus shall have created pus interior, leeches and cold applications will rather retard the Poultices, and early evacuations, are then most to be relied Extensive collections of pus, and sinuses, are often the result of delay in eliminating the virus. The opening of a bubo at an early stage with a sharp lancet, even should no pus exist within, empties the congested vessels, and rather promotes a cure. Blisters and iodide of potassium will be found of use in assisting in absorption. In an indolent bubo an alterative course of mercury, and good diet are necessary.

*Constitutional Symptoms.*—These are secondary and tertiary.

The *secondary* symptoms speedily follow the primary, usually during the second month; consisting chiefly of general eruption, affection of the throat, fever, change of complexion, dryness of hair, rheumatic pains in shoulder and knee, headache. Different kinds of eruption follow different kinds of primary sore, although there may be irregularity in this respect. Periostitis is apt to manifest itself in the shins. Secondary symptoms are transmissible from husband to wife, wife to child, child to nurse.

*Treatment.*—The object is to assist nature in the elimination of the poison; hence we should not suppress the eruption, but act on the skin, kidneys, bowels, and other organs of excretion. The throat should be fomented, and touched with nitrate of silver. Mercury is not to be used if possible, especially in scrofulous, weak temperaments, or when the constitution is broken by dissipation, or the previous abuse of mercury. Small doses of corrosive sublimate, or the protiodide of mercury, is the best form of administration. But the iodide of potash is the most effective remedy in this disease. It is given in doses of 4 or 5 grains three times a day. Baths are most important; sometimes their value is increased by medicating them. Sulphur, and weak solutions of mercury seem to exercise the best influence upon the local affections of the skin.

*Tertiary Symptoms.*—These seldom occur, except after the worse kinds of sore, unless mercury has been rashly used. The periosteum and bones are affected by a chronic inflammatory process. Suppuration, caries, and necrosis result; also, stiff joints, tubercular formations of the skin, and condylomatous tumours. Destruction of the gums, cheeks, deafness, and iritis are also among the consequences. These symptoms are not transmissible.

*Treatment.*—More dependence is to be placed upon the iodide of potassium, than any single remedy. The general remedies will consist of bathing, regimen, and alteratives. Opium and blisters are necessary to relieve the pain in the bones at night.

## DISEASES OF THE URINO-GENITAL ORGANS.

### STRICTURE OF THE URETHRA.

#### SPASMODIC STRICTURE

Depends on spasm of the muscles connected with the membranous

of the urethra. It generally occurs in persons with some
ent obstruction; exposure to cold, and indulgence in drink
vour an attack, which usually occurs after dinner. Cantha-
bsorbed from blisters produces the effect.

*ptoms.*—Sudden retention of urine; great straining and de-
urinate; the bladder becomes distended, the countenance
s, the pulse quick, the skin hot; at last the bladder bursts,
travasates into the peritoneum, or perineum.

### INFLAMMATORY STRICTURE.

is another variety of the above, generally caused by abuse
ctions, exposure, or intemperance during acute gonorrhœa.

*tment.*—A catheter should be introduced at once. This is
ed by introducing as large an instrument as the parts will
of, and stretching the penis forward on the catheter, whose
t the same time should be directed towards the upper surface
urethra, and pressed steadily, but gently, against any obstruc-
Relaxation of the spasm may also be produced by bleeding,
bath, Dover's powder, laudanum enemata, and cold water upon
nitals. Should all these means fail, and life be endangered,
adder should be punctured from the rectum, or opened by a
l section.

### PERMANENT STRICTURE.

is a contraction from permanent inflammation, plastic deposit
taken place in the submucous cellular tissue. The *occasion*
inflammation may be clap, venery, kicks or blows, riding on
ack, acrid urine, drinkings, &c. The most frequent *sites* are
commencement of the membranous portion of the urethra,
o within a few inches of the glans penis. The *extent* and
of contraction vary: sometimes the stricture is very tight,
nited, as if a thread had been tied around the urethra; more
ntly it is of greater extent, continuing from a quarter of an
several inches. Several strictures may exist at once. Behind
icture the urethra is enlarged, and serves to catch a calculus.

*ptoms.*—These come on gradually: middle-aged men are most
Urination is frequent, tedious, and painful: the stream is
wisted, or forked. After urination a few drops pass which had
ed behind the stricture. Pain in the perineum, thighs, and
erection is often painful: semen does not escape in coition,
sses into the bladder, and afterwards is voided with the urine;
nd fever constantly occurring, as in ague: a slight discharge
ble at the end of the penis upon rising in the morning; the
s, rectum, and bowels sympathize, and the general health

*tment.*—1st. *Dilatation* by bougies of flexible metal, silver, or gum elastic, of sufficient size, since small bougies are more apt to be entangled than large ones. The natural structures are not to be mistaken for strictures, viz., an enlarged lacuna in the fossa; spasmodic contraction of the accelerator urinæ muscle; the triangular ligament, and prostate gland. The operation must be frequent and cautious until the cure is complete, and even afterwards, to prevent return of this disease, which is not uncommon; indeed there is no certainty that it will not return. 2d. *Caustic* applied firmly to the stricture; it destroys irritability, but is more advantageous in stricture near the glans than the bladder. 3d. *Puncturation*, by means of a lanceted stilet, introduced concealed in a silver canula; after the division, a catheter is to be introduced. 4th. *Opening the urethra* through the perineum, resembling a lithotomy operation; a catheter is then introduced into the bladder, and the wound heals over it.

## FISTULA IN PERINÆO.

This is usually the result of abscess of the perineum, or a wound. The patient has rigors, fever, and an exquisitely painful prominence in the perineum, which opens and discharges, much to the relief of the sufferer. The opening, however, often remains, and through it the urine dribbles. This abscess may be caused by a kick, or urinous infiltration from an internal fistula, produced by a stricture.

*Treatment.*—This should be directed to the cause; if a stricture exist, this should be cured first, and then the fistula, by caustic application, the application of a red-hot wire, or by paring the edges.

## ENLARGED PROSTATE.

The gland is enlarged, from chronic inflammation, brought on by gleet, stricture, horse exercise, &c.; it is most common in middle life, and disappears upon the removal of the cause. Leeches, rest, counter-irritation, iodide of potash, laxatives, and enemata, are the proper treatment. But the gland is also enlarged in old persons,—a hypertrophy independent of inflammation. This enlargement takes place first in the middle lobe, and the lateral lobes enlarge unequally. The bladder sympathizes, and becomes irritable; the urine is fœtid, mucous, and its stains are often retained. Catheterism, opiates, laxatives, and regimen are the palliatives.

## INFLAMMATION OF THE BLADDER.

This is usually a secondary affection, usually resulting from gonorrhœa, &c. There is pain in the perineum and sacrum; mic-ı is frequent, with straining; **the urine is mixed with mucus**

*:tment.*—Bleeding, leeches, **hip-bath, opiate enemata, castor**

*ɔnic Inflammation.* ***Catarrhus Vesicæ*.—May result from**
ne causes as the **acute form; and also from over-distension of**
dder: it is attended **with great irritability and incontinence**
e. The irritability **and incontinence are sometimes the most**
ent symptoms; **and for these symptoms the injection of a**
ı of sulphate of **morphia, or nitrate of silver, will be found**
erviceable.

### ORCHITIS.

*lled Testicle* is a common **accompaniment of mumps. It is**
he result of an injury; **but, oftener, of gonorrhœa and its**
nt: exercise, wet, and **cold, often induce it. Sometimes it**
ed *hernia humoralis.*
*ptoms.*—There is a **great sense of weight, and the swelling**
tly increases; the skin **becomes tense, red, and glistening; the**
intense, often producing **fever and vomiting. The cord is**
wollen and painful. **The epididymis is chiefly affected. The**
l discharge diminishes.
*tment.*—Bleeding, in a plethoric habit; leeches, purgatives,
emetic, and opium; cold or warm lotions, according to the
's feelings. Low diet and the recumbent position are essen-
The weight of the tumour must be sustained by a suspensory
lkerchief. After the acute symptoms have subsided, friction
ercurial ointment, astringent lotions, and compression by ad-
straps, will be useful. In discussing the hardness and swell-
ich generally remain, the iodide of potash has the best effect.
s may result, but it oftener results from chronic inflammation
ocele.
*algia* of testes causes such severe pain that patients fre-
apply to be castrated. The cause should be ascertained
treatment is commenced.

### HYDROCELE.

**is a collection** of serum in the tunica vaginalis testis; com-
**g at the lower** part of the scrotum, and gradually ascending.
**nooth on its** surface, fluctuating. The testicle is
**terior part** of the sac, near the middle. It is to
**l from hernia** by its transparency and pro
**upon coughing**: it does not retire by r
***tment.*—The** *palliative* treatment consi

the serum by a trocar. The *radical* cure is performed by injecting stimulating fluids, such as port wine and water, or solutions of zinc and iodine into the sac; or, by introducing a seton.

### CIRSOCELE.

Varicocele or cirsocele is a varicose condition of the veins of the cord. Some restrict the term varicocele to the enlargement of the veins of the scrotum. The *causes* are such as produce obstruction to the return of blood; constipation, corpulence, tight belts around the abdomen, and warm climate. The left side is more frequently affected than the right, because the left spermatic vein is more likely to be compressed by fæces in the sigmoid flexure, and because it is longer and not so direct in its course. The swelling is pyriform, and feels like a bunch of earth-worms.

*Treatment.*—The disease may be palliated or cured by removing the causes, bathing the testicle in cold water constantly, and supporting it with a suspensory. The radical cure often requires an operation for obliteration of the veins,—such as the actual cautery, compression by sutures, wires, springs, &c. The scrotum may be diminished with advantage.

## ANEURISM.

An aneurism is a pulsating sac, filled with blood, which communicates with an artery.

### A TRUE ANEURISM.

Is the result of disease, and the sac consists of one or more of the coats of the artery. The artery may be dilated, all the coats being entire, as is usually the case in the aorta; or, the internal and middle coats may be ruptured, and the sac is formed of the external coat. The interior of the sac is lined by fibrin in a membranous form.

### FALSE ANEURISM.

Is owing to a complete division of the arterial coats, either from a wound or external ulceration; the sac is formed in the cellular tissue.

### DISSECTING ANEURISM.

Is a sac formed by the infiltration of blood between the coats of an artery. This sac may communicate with an artery at several points.

### CIRCUMSCRIBED AND DIFFUSED ANEURISM.

Are terms used to signify its limits; whether confined to a cyst, or extending by infiltration into the surrounding tissues.

*nptoms.*—The most frequent form of Aneurism is the *true cir-*
*ribed aneurism.* The tumour, at first, is small, gradually
sing, soft, and quite compressible, being only filled with fluid
It has a distinct pulsation from the beginning, synchro-
vith the heart's impulse, increased by pressure on the distal
nd diminished or arrested by pressure on the cardiac side.
uliar thrill is imparted to the hand, which can be heard by
ation of the ear. At first the pain is slight, and merely
to interference from the adjoining textures. By pressure
he nerves a numbness is produced; pressure on the veins and
atics causes œdema, discoloration, and swelling. The strength
part is much impaired, as the tumour enlarges; the circula-
n the extremity is weaker; the diminished volume of the
rtery is compensated by enlargement of the side channels,
llateral circulation conveying the blood from the cardiac to
stal side of the tumour. The tumour gradually becomes larger
separation of fibrin, is less compressible, and pulsates less
tly. The clot thus filling up the sac, restrains its further
ion by the force of the heart. Ultimately, it may become
r by continued absorption.

ing the progress of an aneurism, adjacent parts are displaced,
l, and absorbed, even bone is rendered carious and absorbed
constant pressure of the tumour. As the tumour enlarges,
nd numbness increase, and the general health fails. At length
mour may burst, opening upon the skin or some important
, and prove fatal, either by hemorrhage, or by pressure on
tant parts,—as the trachea, œsophagus, &c., or by suppura-
nd hectic.

diagnosis from abscesses, glands, and solid tumours is impor-
An aneurism is soft and compressible from the first, and
becomes hard, whereas an abscess begins with induration and
with softening. A tumour or other swelling, receiving an
se from lying over the track of an artery, will no longer pul-
hen raised or held to one side. An aneurism expands coin-
ly with pulsation; a solid tumour will not alter its volume
ssure either upon the distal or cardiac side.

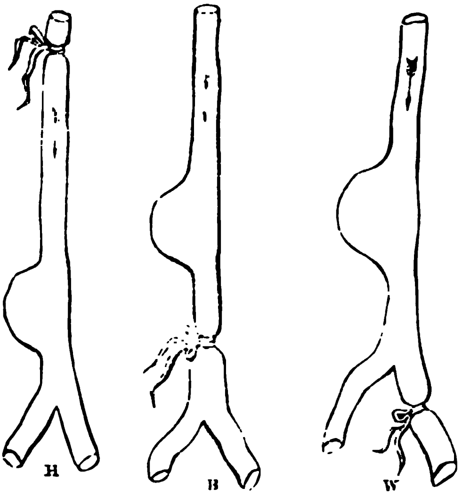
*uses.*—The disease is more frequent in men than in women,
ldom occurs before puberty; the *predisposing* cause may be
be disease of the coats of the arteries; the *exciting* causes
uscular exertion, mental emotion, and intemperance.

*re.*—This may either be spontaneous or surgical—the sponta-
being owing to pressure on the cardiac side of the tumour,
ion of the aperture of communication, coagulation and absorp-
or by inflammation from sloughing of the cyst; this however
ner the cause of death, than a means of cure. Medical treat-
may mitigate the symptoms, such as bleeding, rigid diet, hori-
*position,* and cold and astringent applications.

*Compression* is a means of cure, which is slow and painful.

The *ligature* is alone to be relied on. Previous to the time of Hunter, the vessel was tied immediately above the tumour, and the sac opened. Hunter tied the artery at a distance from the sac, in a healthy part, and allowed the sac and its contents to be absorbed; *this* is the present mode of operating. Abernethy applied two ligatures, and divided the artery between them. Brasdor's operation is directly the opposite to Hunter's, tying the artery immediately beyond the tumour. Wardrop modified this, and tied the artery beyond the tumour and beyond its first bifurcation. The effect of a ligature is to arrest the blood and divide the internal and middle coats; a coagulum or plug is formed up to the first branch, and lymph is effused from the cut edges of these coats, and also surrounds the ligature upon the exterior of the artery. The lymph in the artery above the ligature firmly consolidates the internal and middle coats; and the cellular coat being compressed by the ligature is subsequently destroyed, and thus the ligature is removed with its noose entire; finally the portion of the artery which had been included in the ligature will be found converted into a small cord.

Fig. 28.



The ligature should be round and small, or the coats will not be divided; inclusion of cellular tissue or a nerve will also prevent this division.

*Secondary hemorrhage* may result from the application of an improper ligature, or its premature removal, and also from the artery being too much exposed, or in a diseased condition.

### ANEURISM OF THE AORTA.

The *arch* of the aorta is especially liable to aneurism, producing difficulty of breathing, pain in the chest, and palpitation of the heart, difficulty of swallowing, and troublesome cough, owing to its pressure upon the trachea, which is sometimes perforated; it should mistaken for an enlargement of the bronchial glands, or col- of serum or pus.

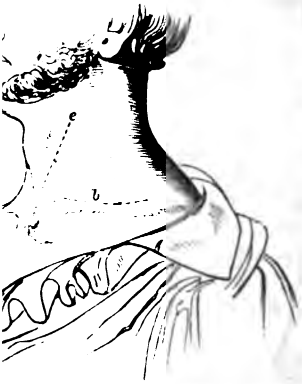
rism of the abdominal aorta is usually situated just below hragm, producing pressure on the thoracic duct, also caries ertebra, dropsy, and by its rupture, death.

y Cooper, James, and Murray have tied it without success; l be treated only by medical means.

### ANEURISM OF THE CAROTID.

occurs most frequently in labouring people; it is situated at e of the jaw, near the bifurcation of the artery, and pro- fficulty of swallowing and breathing; it is to be carefully distinguished from glandular enlargement. It was first tied by Sir Astley Cooper in 1805. The operation is thus performed: the patient being recumbent, with the head thrown back, and slightly turned to the opposite side, an incision three inches in length is made along the inner border of the sterno-mastoid muscle, through the integuments, platysma and superficial fascia, extending from near the angle of the jaw to the cricoid cartilage.

Fig. 29.



The cross veins, descendens noni nerve, and the omo-hyoid muscle should be pushed aside, the sheath opened, and the aneurismal needle ed between the artery and the internal jugular vein, which the outer side; great care should also be taken not to include vagum nerve, which is included in the same sheath.

### AXILLARY ANEURISM.

umour occupies the arm-pit and sometimes extends above icle, producing pain and numbness in the arm. The opera- ying the artery *above the clavicle* is thus performed: the is placed upon a high table and the shoulder forcibly de- an incision (*b*. fig. 29), is made over the clavicle. and platysma myoides, reaching from the anteri ezius to a little beyond the posterior edge of th ical fascia is then divided, the external jugul d the omo-hyoid disclosed; in the triang muscle and the clavicle, we find the artery at the outer edge of the scalenus muscle, passing over the first rib, with the nerves forming the brachial plexus above it, and the subclavian vein somewhat in front and below. Great caution should be used in exposing the vessel, on account of the varieties of the arterial distribution in the neck; it should also be recollected the phrenic nerve descends upon the anterior face of the scalenus anticus muscle.

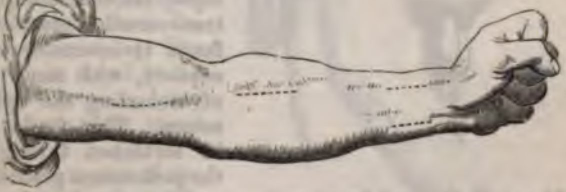
The artery is tied also below the clavicle by making a semicircular incision, with the convexity upwards, from near the sternal end of the clavicle towards the acromial, carefully avoiding the cephalic vein and acromial thoracic artery, which pass between the outer edge of the pectoralis major muscle and the deltoid. After dividing the skin, superficial fascia, and pectoralis major, the pectoralis minor will be exposed, between the upper edge of which and the lower edge of the subclavian muscle, the artery will be found deeply imbedded in cellular tissue and fat; the vein is in front, and the axillary plexus of nerves surround the artery.

The arteria innominata has been tied, but without much success where the tumour is large. The patient lying on his back, with his shoulders raised, and the head thrown back, an incision two inches in length is made on the inner side of the sterno-cleido-mastoid, reaching to the sternum; another incision is made just above the clavicle and through the sterno-mastoid: thus a flap can be turned up; the sterno-thyroid and sterno-hyoid are then to be divided on a director, and the deep fascia exposed; cautiously opening this fascia, the vein is to be pushed aside, avoiding the par vagum, recurrent, and cardiac nerves.

### BRACHIAL ANEURISM.

This is usually the result of violence, and is very often a false aneurism; the tumour is in the bend of the arm, and inconveniences its mobility.

Fig. 30.

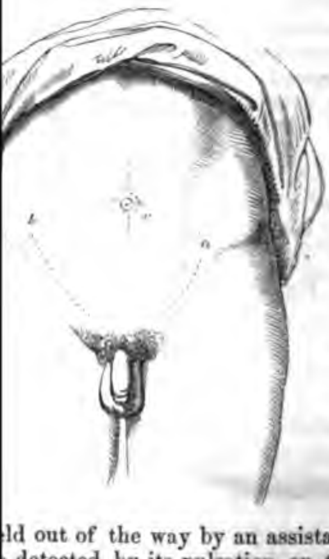


The brachial or humeral artery is tied by making an incision on the inner edge of the biceps flexor muscle, of two inches in length, about the middle of the arm. The median nerve will be found first, lose to the artery; this and the veins are to be carefully se- . It must be borne in mind, that the artery may bifurcate as the axilla. If it be necessary to tie the artery in the portion of the arm, an incision is to be made over the pul- vessel, and it will be found on the inner edge of the coraco- lis muscle; the nerves and veins are to be carefully avoided. gation of the *radial* and *ulnar* arteries is seldom required for wounds. Often wounds in the palm of the hand require ng of the humeral artery. The radial may be exposed in per part of the forearm, by an incision through the skin and cial fascia. By separating the supinator longus muscle from onator teres, the artery will be found as it passes over the of the pronator. In the lower part of the forearm the *radial* readily exposed by making an incision through the skin and on the outer border of the flexor carpi radialis; and the *ulnar* ncision on the radial side of the flexor carpi ulnaris muscle.

### INGUINAL ANEURISM.

is a pulsating tumour in the groin, not to be mistaken for a bubo, hernia, &c. The external iliac is tied by making an incision (*a*, Fig. 31), about 3½ inches in length, commencing on a level with the anterior superior spinous process, and about an inch distant from it; and continued nearly parallel with Poupart's ligament, to a point 1 inch above, and 1½ inches to the outside of the pubes. Carefully cutting through the skin, superficial fascia, tendon of the external oblique, internal oblique, and transversalis muscles, the fascia transversalis will be exposed, with some danger of wounding the epigastric artery. This fascia should be scratched through, and the peritoneum pushed aside, ld out of the way by an assistant with a spatula: the artery detected by its pulsation on the inner border of the psoas , the vein being on its inner side. The operation for tying ternal iliac or the common iliac is made by making an in-

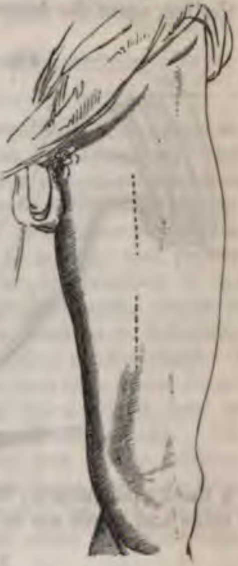
Fig. 31.



cision *b*. The letter *c* shows the incision of Sir Astley Cooper when he tied the aorta.

### POPLITEAL ANEURISM.

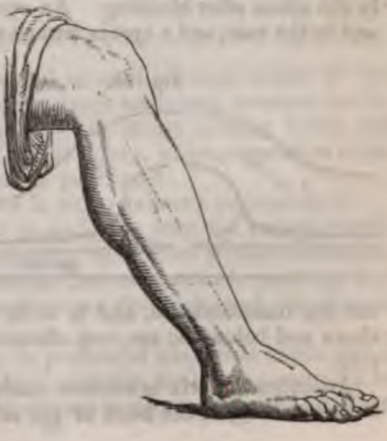
Fig. 32.



This is of frequent occurrence, and occupies the space between the hamstrings behind the knee, causing pain, numbness and swelling of the leg, disease of the joint, &c.

The operation is to tie the femoral artery. The patient being properly placed, the sartorius muscle is rendered prominent by raising and adducting the thigh. An incision of two or three inches in length is made upon the inner side of the sartorius muscle, in the upper part of the thigh, according to Scarpa, where the artery is superficial. The saphena vein is to be regarded in the dissection of the superficial fascia. After opening the sheath, care must be taken not to injure the vein, nor to include the saphenus nerve. Hunter's operation is somewhat below, and in its performance the sartorius must be divided or pushed aside.—The *anterior tibial* artery may be tied in several places: at the upper part of the leg, by a free incision, so as to get between the tibialis anticus and extensor communis digitorum. After the division of the superficial fascia, a proper allowance should be made for the breadth of the tibialis anticus, in order to strike the line of division upon the dense fascia between the two muscles. The artery will be found at the bottom of this space, lying on the interosseous membrane.

Fig. 33.

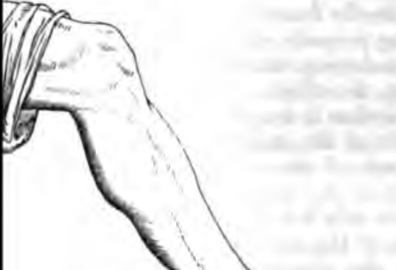


At the lower part of the leg a less incision is necessary, the vessel being more superficial. The wound is made on the tibial side of tensor proprius pollicis. The venæ comites and anterior tibial are to be avoided.

the instep the artery may be secured by making an incision fibular side of the tendon of the extensor proprius pollicis.

e *posterior tibial* may be readily tied near the middle of g, upon the inner side; divide the skin, superficial fascia, crural fascia, and some fibres of the soleus, and the leg being flexed, the triceps suræ can be pushed aside sufficiently to expose the sheath of the vessels; the artery is to be carefully excluded from the veins and nerve.

Fig. 34.

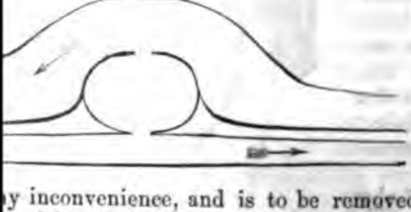


At the ankle the operation is simple. A semilunar incision is made, posterior to the internal malleolus, through the skin and superficial fascia, and k aponeurosis; this exposes the sheath of the vessels. The and nerve are to be excluded.

### VARICOSE ANEURISM.

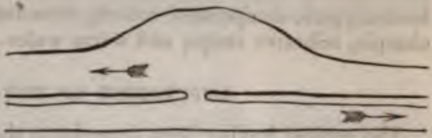
s is usually the result of a wound, and occurs most frequently elbow after bleeding. An opening remains both in the artery the vein, and a cyst is formed with this double communication. The arterial blood enters the vein, and produces greater or less distension of it. This enlargement of the vein is recognised by a peculiar thrill, resembling the purr of a cat: it may exist for some time with- y inconvenience, and is to be removed by tying the artery and below the sac, and oftentimes it is necessary to tie the

Fig. 35.



eurismal varix is another variety, occurring under the same nstances, at the bend of the arm. The vein and artery communicate, as in the former, but without any cyst interposed; the swelling is less, but more diffused, and varicose distension of the veins is very great. The limb below the tumour is imperfectly supplied with arterial blood, and, consequently, cold, numb and vitally weak, and also liable to congestion and œdema. It is to be treated by pressure, so as to repress the swelling, and moderate the sanguineous mixture: this will palliate the symptoms, and permit the use of the limb. A permanent cure can only be effected by tying the artery above and below the aperture of communication.

Fig. 36.



*Aneurism by anastomosis* presents itself in various forms: 1. Capillaries of a portion of integument may be equally and permanently dilated, producing discoloration and slight elevation of the part. This is one form of nævus, or congenital mark, which is attended with no danger, and may be considered as a deformity rather than as a disease. 2d. The structure may consist chiefly of dilated veins fed by arterial branches. This structure is not found in the true skin, but in the adjacent cellular tissue; or it may be submucous, as is exemplified by one variety of hemorrhoid. 3d. The swelling may consist chiefly of dilated and active arteries, supplied with large tortuous veins, which are mere conduits from the tumour; the tumour is erectile, and varies in bulk and tension, according to the state of the circulation. It often grows rapidly, and brings life into imminent peril.

Its removal may require the knife, excision, or compression.

## AMPUTATION.

Amputation is not to be resorted to until all other means of cure have failed. In cases of gangrene, large malignant tumours involving a bone or a joint, diseases of the joints causing hectic and threatening life, and in case of recent injury, where reparation is impossible, then amputation must be performed.

In case of injury, amputation is either primary or secondary:

*Primary;* when performed immediately after the patient has recovered from the shock of the injury, and before febrile excitement.

*Secondary;* after suppuration has commenced, and perhaps sloughing. Secondary amputations are also performed for diseases of the bones or joints.

Primary amputations are to be performed when it is impossible to save the injured limb. In military practice, limbs are amputated for injuries, which a surgeon might attempt to save in civil practice; there

less opportunity for treatment, and less favourable opportunity
ondary amputation.

*ruments and Dressings.*—Amputating knives, catlins saw,
quets, scalpels, tenacula, forceps, needles, ligatures, sponges,
ippers, compresses, rollers, retractors, lint spread with cerate,
e, adhesive strips, and warm water.

## AMPUTATION OF THE THIGH.

patient having been brought to the edge of the bed, his back
ported by pillows, and his hands held by assistants. The
quet is applied over the superficial portion of the artery, about
inches below the groin, so as to interrupt the circulation of
n the limb. This, like other amputations, may be performed
ways, either by the circular incision or by the flap operation.

### CIRCULAR INCISION.

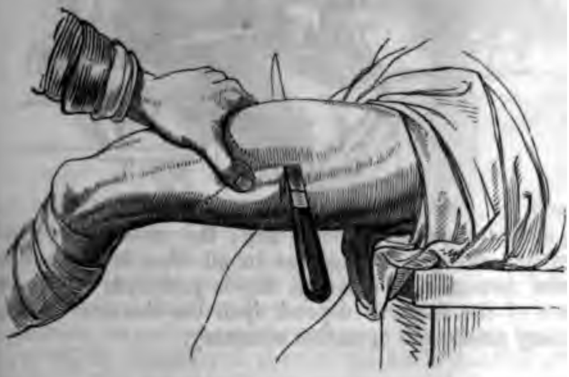
surgeon stands so that he may use his left hand to grasp the
hich he is to amputate, the leg being firmly supported, in a
ntal position, by an assistant; the surgeon then carries the
ating knife under the limb, and with one complete sweep round
nb, divides the skin, fat, and fascia. A scalpel is then used
ect the integuments from the muscles, in order that they may
ned up, for two inches, in the same way that one would turn
cuff of a coat. With the amputating knife, the muscles are
it through down to the bone, the edge of the knife being in-
upwards, in order that the stump may present somewhat of a
al cavity; the muscles are to be slightly separated from the
and a retractor applied to pull them upwards. In using the
he heel should first be applied on the bone, and a groove
by steady strokes the bone is divided, care being taken to
t splintering and roughness: in case there should be any, it
removed by bone-nippers. The large vessels can now be tied,
e stump sponged with warm water, in order to detect orifices
ller ones. After hemorrhage is completely arrested, and the
quet somewhat loosened, the end of the bone is to be covered
muscles and skin, so as to form a rounded stump; the edges
be retained by adhesive strips, and the ligatures brought out
corners of the wound. The stump is now covered by lint
with cerate, and over this a thin pledget of charpie or tow;
hole is supported and covered by a roller, which should
ied once or twice around the patient's pelvis. Having been
ly placed in bed, the stump is supported upon a pillow, and
l to it by pins; over the stump is placed a frame, to take off
ight of the bedclothes. During the winter the dressings may
on seven or eight days; in summer only two or three; a

ice previously applied may facilitate their removal. The after-
ings may be repeated once in forty-eight hours. About the tenth
he ligatures may come away, and generally, the wound is healed
ree or four weeks. Some suppose that the stump may be better
ed by *flap operation*, especially should the integument be

### FLAP OPERATION.

e original plan of Vermale was, to introduce a knife perpen-
arly to the anterior surface of the thigh, and to cut a lateral

Fig. 37.



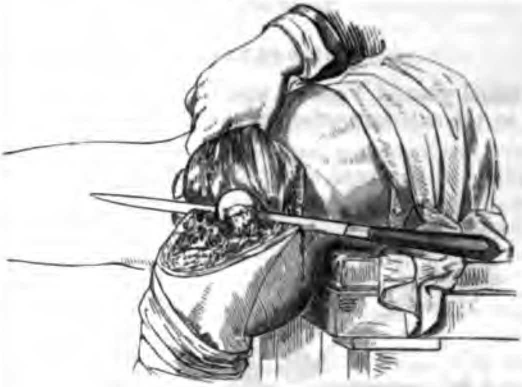
either side. Liston and others prefer an anterior and pos-
flap, which prevent the end of the bone rising at the upper
f the wound, and protruding forwards. These are made by in-
the knife by the side of the thigh, as in Fig. 37, instead of
s anterior surface. The objections to the flap operation are
uries to vessels and nerves, by transfixion and oblique divi-

### AMPUTATION AT THE HIP JOINT.

operation is rarely necessary, and is always severe and dan-
; it should never be performed for disease of the joint. The
is to be placed on a table, with his pelvis projecting from
e. The artery is compressed by an assistant, who must be
thrust his fingers in the wound formed during the forma-
the anterior flap, so that he can grasp the end of the vessel,
as it is cut. The knife is entered about middle way between
chanter major and the anterior superior spinous process of

m. By cutting downwards, the anterior flap is formed. The f the bone is then disarticulated, and the blade of the knife hen placed behind the bone, is carried downwards and back-

Fig. 38.



so as to form a posterior flap; the vessels are to be rapidly l, and the flap managed as in all other flap operations. By he formation of a lateral flap is preferred. Very often the n of the flap will depend upon the character of the wound may render the operation necessary.

## AMPUTATION OF THE LEG.

length of the stump will, in some measure, depend upon the f artificial limb to be used. If the patient is to rest upon his he stump should be short, in order to be bent at right angles.

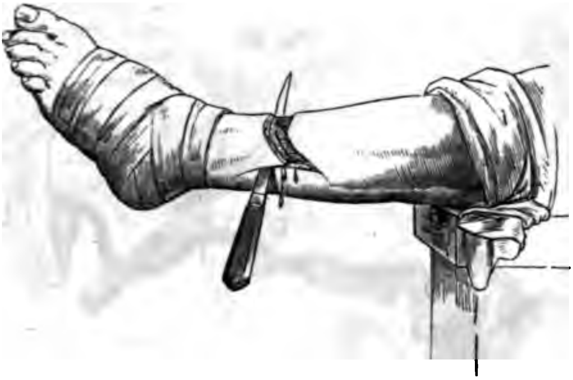
### CIRCULAR METHOD.

tourniquet having been applied, the integuments are to be l, dissected up, and turned back for two inches; the muscles be divided, down to the bone, by a second circular incision. catlin is to be passed between the bones, so as to divide the seous ligament and muscles; a three-tailed retractor is then to lied, and the bones sawn through together. If the spine of ia projects much, it can be removed by a fine saw, or bone-s. The vessels are to be secured, and the stump treated as utation of the thigh, the integuments being brought together raight line.

### FLAP OPERATION.

This is generally preferred, and is thus performed. The surgeon first places the heel of the knife on the side of the limb, farthest from him, and draws it across the front of the limb, in a semicircular direction, making a semilunar flap. When its point has arrived at the opposite side, it is at once made to transfix the limb, and then the larger and posterior flap is cut. In transfixing the limb, care must be taken not to pass the knife between the bones. This amputation may also be performed near the ankle; but, in this instance, it will be necessary to shorten the tendo Achillis after the flap is made. The leg should not be amputated nearer the knee than the tuberosity of the tibia, or the joint will be opened, and inflammation result. Hence *amputation at the knee* is rarely performed, although disarticulation may be readily performed with a large scalpel. In this operation the patella should be allowed to remain.

Fig. 89.



## AMPUTATION OF THE FOOT.

The foot is amputated at two places.

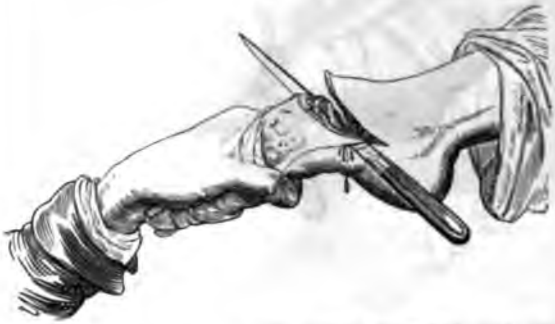
### CHOPART'S OPERATION.

A flap is made from the upper part of the instep, and the disarticulation commenced immediately behind the tuberosity of the scaphoid bone. The bistoury is passed between the scaphoid and head of the astragalus, and then between the cuboid and os calcis: an inferior flap is then made from the sole of the foot.

### HEY'S OPERATION.

disarticulation is commenced immediately behind the tube- of the fifth metatarsal bone; separating the fifth and fourth rsal bones from the cuboid, the third and second from the al and middle cuneiform bones. The internal cuneiform is removed or sawed through. The superior flap is made before sarticulation, and the inferior one subsequently.

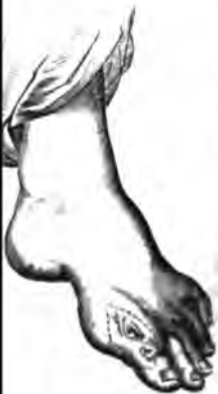
Fig. 40.



### AMPUTATION OF THE GREAT TOE.

most convenient mode of removing this toe is by incisions ented by dotted lines in this figure. Commencing upon the inner side of the metatarsal bone, and running round the joint obliquely, taking care not to wound the anterior tibial artery. The flap is made from the outer side of the toe. It will cover the head of the metatarsal bone more perfectly, and can be more readily retained in its position than any other.

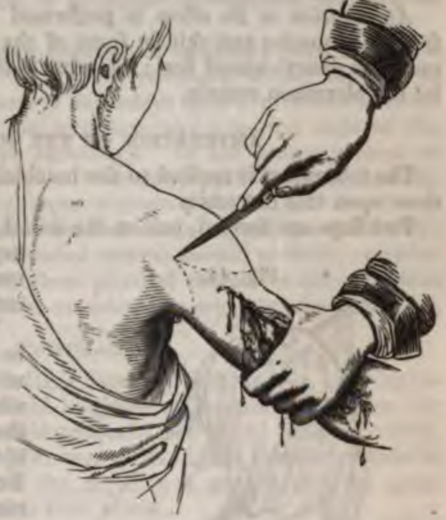
Fig. 41.



### AMPUTATION AT THE SHOULDER JOINT.

Hemorrhage is to be restrained by pressure with the fingers, or the handle of a key well padded, upon the subclavian artery, as it passes over the first rib. The flaps may be cut by transfixion, or in the manner represented in Fig. 42. The external flap should be made first, out of the deltoid, and then the head of the bone disarticulated. The internal flap is smaller, and made last, in order that the vessel may be secured immediately upon the limb being severed. In some instances it may be necessary to remove the whole of the scapula, and one half of the clavicle. The extent and character of the injury must often determine the shape of the flaps.

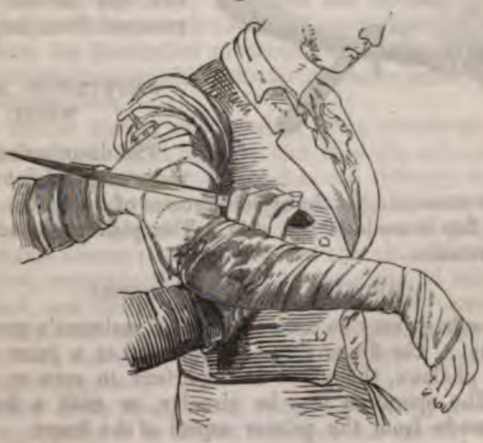
Fig. 42.



## AMPUTATION OF THE ARM.

The circular operation is most frequently performed. The artery is compressed by a tourniquet or the fingers, and the skin drawn firmly back. One circular incision will divide the skin and fascia; another will divide the muscles. If the knife is held so that the edge is

Fig. 43.



. slightly toward the shoulder, the end of the bone will be n a conical cavity, and can be well covered by the muscles a.

lap operation is sometimes performed. The arm being transie anterior flap is made first; the vessels are divided when erior flap is cut.

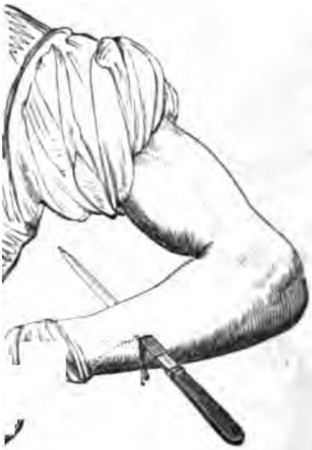
*utation at the elbow* is performed by making a single flap e muscles and skin in front of the joint. The head of the s disarticulated first: the ulna is then to be sawed, so as to olecranon remain.

### AMPUTATION OF THE FOREARM.

ourniquet is applied to the brachial artery as in other operaon this extremity.

flaps are formed, one on the dorsal, the other on the palmar aspect. These are best made by transfixing and cutting outwards.

Fig. 44.



The amputation should be performed as near the wrist as circumstances will admit of; although below the middle it is not easy to obtain sufficiency of flaps. But, the general rule is, to remove as little as possible from the organs of prehension: and operations are attended with less risk to life the farther they are removed from the trunk.

### AMPUTATION AT THE WRIST.

The disarticulation of the radio-carpal joint is readily by commencing at the styloid process of the radius. A dorsal nar flap is made of the skin. The pisiform bone is to be to remain.

### AMPUTATION OF THE FINGERS.

emorrhage may be controlled by an assistant ghtly. The finger may be amputated at a j of a phalanx, though it is important to sav. . The operation may be circular, or with a be made from the palmar aspect of the finger.

## CANCER.

Malignant diseases change the original structure of the part, transform or destroy the surrounding tissues, travel in the course of the lymphatics, contaminate the nearest glands, affect several organs in the same individual, and, if mechanically removed, reappear in or near the cicatrix.

Malignant growths contain granules or nucleated cells, imbedded in a fibro-cellular tissue. They are *composed* almost entirely of albumen. Their *development* is dependent upon perverted nutrition. The *causes* are perpetual local irritation, and a morbid state of the constitution, which may be hereditary. In the ordinary sense of the word they are not contagious; but cancer-cells injected into the blood of a dog, produce malignant disease of the lungs.

Cancer is a term applied to several kinds of malignant disease; and under this term are included several morbid growths, *encephaloid*, *schirrhus*, and *colloid*, whose physical characters are so various that they have formerly been considered as separate affections.

### ENCEPHALOID.

This is often called Medullary Sarcoma, Soft Cancer, and Cephaloma. The word Encephaloid is preferred because it denotes the resemblance which the morbid product bears to the brain in colour, texture, and consistence. The tumour is highly vascular, which in some measure accounts for the rapidity of growth and the great size to which tumours of this kind attain.

The skin investing the tumour is pale, with numerous veins coursing beneath it. At first it is moveable on the tumour, but afterwards ultimately incorporated therewith. The growth is not circumscribed and moveable, but fixed and diffused into the surrounding parts. To the touch a sense of great elasticity is imparted, different from the fluctuation of chronic abscess, and different also from the semi-fluctuation which the fatty tumour exhibits, yet somewhat resembling both.

Pain is almost always considerable, often severe and shooting. In some cases it is at first absent; and then the tumour is usually of slow growth, but when it enlarges in the ordinary manner, as it soon does, the pain becomes developed, and continues. The patient is obviously cachectic, and bears on his countenance a plain token of a formidable disease; the features are shrunken and anxious, the hue is sallow, emaciation is begun, the functions of animal life are all disturbed, and hectic is setting in. It attacks more frequently young persons, and may occur in any texture, though most commonly it affects the orbit, testicle, mamma, joints, internal viscera, and lymphatic ganglia.

The section of an encephaloid mass, when fully developed, presents the appearance of an almost homogeneous matter, of an opaque

colour, ordinarily dotted with spots of pinkish hue, varying
erent specimens in number, size, and shape. In consistence
ely resembles the healthy brain of an adult, and may be
up between the fingers with about the same facility as the
nce of that organ; if torn through, the lacerated surface pre-
a coarsely-granular aspect. Sometimes it is divided into
s by fibrous bands intersecting the mass; and in tumours of
erable duration, softening will occur, and the skin will give
So long as the tumour is invested by the integument, it is
be *occult;* when the skin has given way, and the morbid
ire consequently becomes exposed, it is said to be in the *open*
During the softening of encephaloid, the vessels become
l, the effused blood more readily enters the soft tissue, and
with it, than in the harder sorts of cancer; the whole mass
es a sanguineous appearance, and in this way encephaloid
s into *Fungus Hæmatodes.* Black granular pigment may
se enter into the composition of encephaloid, forming *Mela-*

re are certain forms of cancer-cells which are characteristic
ephaloid, for instance, parent-cells with young cells in their
r, cells with numerous cytoblasts, and the irregular caudate
mifying cells. Of all forms of cancer, encephaloid runs the
st course, is the most malignant, and causes death in much
ortest time.

## SCHIRRUS.

irrus usually forms a roundish tumour with a more or less
ted surface. Its consistence is generally very firm; the
r in this respect resembling cartilage or even stone; this
ess depends on its fibrous structure, and varies with the
ness, compactness, and amorphous character of the fibres. Its
s, in cases where the tumour is superficial, are frequently ob-
on the application of the hand, to be of a lower temperature
he surrounding parts; this is probably dependent on the li-
supply of blood to the part. It is much less vascular, and
ch slower growth than encephaloid; softening does not take
as rapidly, and, until this occurs, the life of the patient is
ratively safe. A section of one of these tumours sometimes
s of a bluish-white or milky colour, resembling other fibrous
rs; sometimes it presents a more opaque appearance, and is
with yellow or red; when softening has commenced a caseous
ance is presented. As a general rule, schirrus is intimately
d with the surrounding parts, not being enclosed in a capsule,
senting a definite border. Schirrus has a constant tendency
sition into encephaloid or colloid. The mutual relations be-
the fibres and the cancer-cells vary extremely in schirrus; so

much so, that it is frequently impossible to distinguish some parts of the tumour from encephaloid, and others from fibrous tumour. The cells are small, round or oval, and granular. Schirrus contains a viscid fluid, which, when it occurs in excess, forms the transition to gelatinous cancer. The pain is at first slight, and gradually increases as the disease progresses. It occurs more frequently in women, and attacks the mammary gland, generally after middle life.

### COLLOID.

This variety of cancer consists of a jelly-like matter, enclosed in cellular cavities, varying from the size of a pin's head to that of an egg; the walls of these cavities are composed of fibrous tissue, such as occurs in schirrus, and the jelly is colourless and transparent, containing pale cells, which differ from true cancer-cells, being, generally speaking, larger, more delicate, and the walls not being so thick. No true softening or suppuration occurs in this form of cancer; in the intestinal canal, where it is most frequent, the surrounding tissues become gradually infiltrated with this jelly; strictures are thus formed in the gut, and the contents of the canal being pressed on by the soft gelatinous mass, give rise to perforation of the walls. Hence gelatinous cancer is in some degree different in its progress from the other forms of carcinoma.

*Treatment.*—The treatment of any form of cancer will, in a great measure, depend upon the development of the disease. A small tumour of a schirrous form may be extirpated, with some chance of success, though not with certainty as to its non-reappearance. When the cancer is open and ulcerated, the treatment should be directed to the constitution, which will, sooner or later, sink with symptoms of hectic.

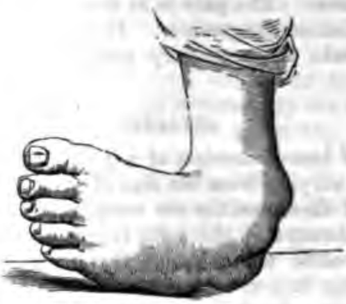
## CLUB-FOOT.

This deformity may be either congenital or acquired. The congenital form is dependent upon some disturbance of the cerebro-spinal system, that produces irregular contraction of the muscles, by which antagonism is destroyed.

The accidental causes by which it may be acquired, are injuries and diseases of the foot or ankle, convulsions, scarlet fever, cicatrices, rickets, &c.

The principal varieties are three:—1. *Talipes Varus,* in which the foot is turned inward, as in Fig. 45, and rests upon its outer edge. There are various grades and modifications of varus. The foot is not dislocated, but the bones deviate from their normal direction, and their articular surfaces are partially separated. The astragalus is least altered in position. The ligaments on the outer side are lengthened, and those on the inner are shortened. The ten-f the tibialis anticus and posticus, and the tendo Achillis, are ontracted; the peronei muscles are relaxed.

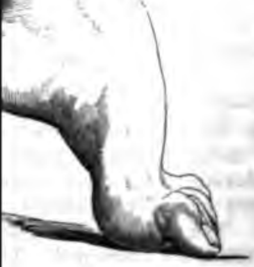
Fig. 45.



*Talipes Valgus.* The foot is everted, and rests on its inner It is a rare form of club-foot. The ligaments on the inner e relaxed. The peronei muscles are contracted, and the tibi ticus and posticus elongated.

*Talipes Equinus.*—In this variety the foot rests upon the r upon the toes. After a person has walked for a number of the deformity is increased, as is represented in the drawing 46). The shortening is due to contraction of the triceps ten nd thickening of the plantar fascia.

Fig. 46.



There are two other varieties; one in which the toes are drawn up by contraction of the extensors, and the patient walks upon the heel; and the other when the dorsum or instep comes in contact with the ground. Besides which there may be various complications of the above.

The *prognosis* will depend upon the degree of contraction, the variety of the deformity, the condition of the bones, and the age of the patient.

*Treatment.*—Many cases of congenital club foot may be rectified by constantly wearing a proper apparatus, especially if the treatment be commenced in early childhood; but in confirmed cases it is better to resort at once to Stromeyer's operation of division of the tendons. The operation is thus performed.

The tendon is put on the stretch, and a narrow, sharp-pointed knife is thrust through the skin externally to the tendon; then the edge is directed towards the tendon and the knife withdrawn, cutting the tendon as it escapes.

The operation will facilitate the cure in most cases, provided the subsequent treatment be effectually maintained; and this depends as much upon the fidelity of the parent or nurse in the constant application of the apparatus as upon the skill of the surgeon.

There may be said to be little or no danger resulting from the operation.

Various foot-boards and shoes are to be worn, by which the deformity is gradually and permanently overcome.

The most favourable period for the operation is between six and eighteen months. Great care is required not to produce excoriation and ulceration of the skin in a young child. Oftentimes it is better to remove the apparatus entirely than run the risk of producing fever or convulsions.

## AFFECTIONS OF THE EYE.

### DISEASES OF THE EYELIDS.

#### HORDEOLUM, OR STYE,

Is a small painful boil, in the cellular tissue upon the edge of the eyelids. Some suppose that it originates in the sebaceous glands at the roots of the cilia, or in the follicles of the ciliæ. A scrofulous constitution predisposes to the occurrence of them.

*Treatment.*—Those who are liable to them should pay attention to the condition of the stomach and bowels. Cold applications and nitrate of silver may arrest it; but generally it suppurates, requiring poulticing and puncturing.

#### OPHTHALMIA TARSI.

This is a chronic inflammation of the edges of the cyelids, occurring most frequently in scrofulous children. The edges are swollen and red; the eyelashes loaded with Meibomian secretion; and the lids are glued together in the morning. There is itching, smarting, and a sensation of stiffness. When the disease is of long standing, the eyelashes fall out, and the new ones are misdirected, and irritate the conjunctiva. In adults it may be the result of catarrhal ophthalmia, or be produced by cold and damp air, or by intemperance. In children it may be the result of eruptive diseases.

*Treatment.*—Alteratives, laxatives, and tonics. The state of the skin requires attention. Fomentation will remove the incrustations nd misdirected eyelashes are to be removed. An ointment ed of gr. x. of red precip. and an ounce of cerate is to be ly applied at night; and in the morning the lids are to be with tepid water, and not separated forcibly. In inveterate ulphate of copper and nitrate of silver may be applied to the in case the conjunctiva is thickened; and blisters may be behind the ears.

### ENTROPION

permanent inversion of the eyelid, and often results from phthalmia, from a relaxation of the integuments of the eye- l spasmodic contraction of orbicularis palpebrarum muscle ong continued, or by contraction of the conjunctiva; constant d irritation follow from the ciliæ rubbing against the ball. be distinguished from *trichiasis,* in which the ciliæ are in- and irritate the ball whilst the lids remain in their natural n.

only treatment which can be of permanent benefit, is the ex- of a fold of skin, from near the edge of the eyelid; but this is pplicable in certain cases where the cause is relaxation of the

### ECTROPION

n eversion of the eyelid, caused often by a thickening of the ctiva from long inflammation, or from cicatrices upon the the eyelid, resulting from a blow or burn. This is to be by bringing the conjunctiva to a healthy condition, by the tion of nitrate of silver or sulphate of copper. Should these es fail, a portion of the conjunctiva is to be excised, or a por- new skin to be substituted for the cicatrix.

### PTOSIS

falling of the upper eyelid, from a palsy of the third nerve, n an injury of the levator palpebræ superioris muscle. It is onnected with congestion of the head, and may be a precursor plexy, and should be treated by bleeding, purgatives, mercury, isters. If persistent, it may be obviated by removing a fold of n from the upper eyelid.

## DISEASES OF THE LACHRYMAL APPARATUS.

### XEROPHTHALMIA

dryness of the eye, arising either from a want of secretion of njunctiva, or, as some suppose, from a deficiency of tears. be remedied by frequently bathing the eye with mucilage.

## EPIPHORA

superabundance of tears, so that they run over the cheeks: it be distinguished from *stillicidium lachrymarum*, which is an w in consequence of an obstruction of the channels that convey the nose. It arises frequently from scrofulous inflammation; a the action of chemical or mechanical agents, cold winds, apours, &c. The treatment will, of course, vary with the

## OBSTRUCTION OF THE LACHRYMAL DUCT

own by the overflow of the tears, the dryness of the nostril, on of the sac, and the formation of a small tumour. It often inflammation and abscess. In other instances, it results in ing of the tubes and duct, which may be much benefitted by of probes. The puncta and canaliculi may be dilated suffi- to admit a probe of the same thickness as the ordinary style.

## TULA LACHRYMALIS

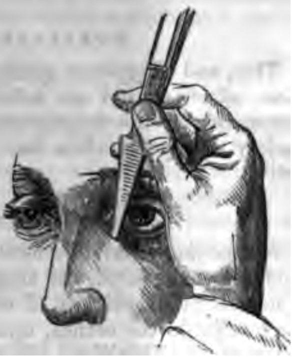


Fig. 47.

aperture at the inner corner ye, the result of a bursting scess caused by obstruction. ammation of the sac is to ed by leeches and cold ap- s. If suppuration cannot ated, the tumour is to be as soon as it has become fluctuating. The opening be made parallel to the of the orbit, and below the of the orbicularis. The ld then be fomented and ly cleansed, and after a , should any doubt exist rence to the perviousness of the tubes and sac, an explora- be made by probes.

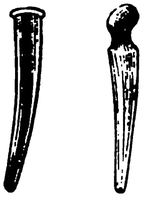


Fig. 48.

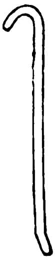


Fig. 49.

l the obstruction be firm, the into the sac will remain fis- nd then a *style* must be intro- The object of the style is to e strictured portion of the sac. n and size is represented in the ey are usually made of lead, gold, and sometimes of catgut. ave thought best that there be a groove on the style, or hould be hollow, but this is unnecessary; for al- he style may occupy the *whole* of the calibre of the hen first introduced, the tears gradually widen it and flow by the side of it.

## DISEASES OF THE CONJUNCTIVA.

### ACUTE CONJUNCTIVITIS.

*ptoms.*—Smarting, heat, stiffness, with a feeling as if dust t into the eye. Subsequently the secretion of mucus in-; which becomes puriform. The vessels of the conjunctiva gid and numerous, giving it a bright-red appearance. There t intolerance of light and increased flow of tears.

*ses.*—Cold or damp, bad condition of stomach, or local irrita-

*tment.*—A dose of calomel followed by a saline cathartic; cold applications, moderately dark room, and a solution of of silver. The disease may become *chronic;* when blisters the ear, and astringent applications to the eye will be

### PURULENT CONJUNCTIVITIS.

, and *Egyptian ophthalmia*, are more severe forms of the ffection, and are infective. The most severe form of in-tion of the conjunctiva is *gonorrhœal ophthalmia;* in this the eye is often lost. The treatment must be early and

### SCROFULOUS CONJUNCTIVITIS.

*ptoms.*—Extreme intolerance of light, the eyelids are spas-lly contracted, the head is turned away from the light, there eneral vascularity of the conjunctiva, but a few vessels run-owards the cornea, terminate in phlyctenulæ, or pustules on rnea. This disease is most obstinate and liable to perpetual ence, often resulting in ulceration of the cornea, or opacity ffusion of lymph between its layers.

*tment.*—Local applications are of no avail unless the general be improved. A dose of calomel and rhubarb should be fol-by tonics and alkalies, and other general remedies for scro-uch as quinine and salt baths. The nitrate of silver exer-more sedative and antiphlogistic influence than any other emedy.

### GRANULAR CONJUNCTIVITIS

thick, rough, fleshy state of the palpebral conjunctiva, de-t upon long-continued inflammation; it causes great pain and ance to the motion of the eye, and if it continues will render

l health must be attended to, and blisters may be applied be-
he ears.

## ULCER OF THE CORNEA.

s most frequently occurs as a result of conjunctivitis, especi-
f the scrofulous form, but may arise from mechanical injury;
n penetrates the cornea and leaves an opaque cicatrix. When
lcer is *healthy*, its surface is somewhat opaque, owing to the
n of lymph; when *inflamed*, vessels will be found approach-
; when *indolent*, it is clear, and transparent, appearing as if
ll piece had been cut out of the cornea. The nitrate of silver
best application to the inflamed and indolent ulcer of the
. If the acetate of lead be used, a white precipitate is
d, which is liable to become fixed in the cicatrix as a dead-
spot.

## SCLEROTITIS.

s disease is often called rheumatic ophthalmia. It is known
lness of the sclerotica, slight intolerance of light, severe aching
f the eye and the bone surrounding it, which is aggravated at
. It is distinguished from conjunctivitis by the character of
in, and redness. In *sclerotitis* the vessels are deep-seated, of
pink colour, and run in straight lines from the circumference
eye towards the cornea; whereas in *conjunctivitis*, the vessels
rtuous, freely anastomose, superficial, and are of a bright-red
r.

*atment.*—Bleeding, purging, together with the administration
lchicum, warm baths, and anodyne fomentations; blisters be-
the ears, and Dover's powder, are also of great avail.

istic means, such as bleeding, purging, and leeching. The tion of lymph is to be promoted, and its fresh effusion ar- by the administration of small doses of calomel and opium four hours, until the gums become affected. The pupil should t well dilated by belladonna or stramonium, and the pain e relieved by anodyne fomentations and nightly doses of opium. *ficial Pupil.*—It is often necessary to form a new aperture in , owing to the pupil having been obliterated by inflammation.

### CATARACT

n opacity of the lens or its capsules. It may be caused by in- ation or injury, but is more frequently the result of impaired on. There are different varieties of cataract, designated by rms hard, soft, radiated, capsular, &c.

*nptoms.*—The vision becomes gradually impaired, and objects as if surrounded by a mist or cloud. The sight is better in the g, or after the application of belladonna, because the pupil dilated, more light passes through that part of the lens which et be transparent. The pupil is active, and behind it is an body of a grayish-white or amber colour. The catoptric test most certain mode of distinguishing it from amaurosis and ma. When a lighted candle is held before the healthy or otic eye, three images of it may be seen: an erect image, that upwards when the candle is moved upwards, which is pro- by reflection from the surface of the cornea; another erect produced by reflection from the anterior surface of the lens, also moves upwards when the candle moves upwards; and a mall inverted image, that is reflected from the posterior sur- f the crystalline, that moves downwards when the candle is upwards. In cataract, this inverted image is from the first ed indistinct, and soon abolished; and the deep erect one is bolished also.

*atment.*—There is no cure but by an operation, which should erred until the patient is in good health and condition. If s moves freely, and there is no tendency to vascular disturb- n the eye or head, the chances are favourable.—There are modes of operating, before performing either of which the should be dilated by belladonna or stramonium.

*raction.*—An incision is made through one half of the circum- of the cornea, the capsule of the lens lacerated, and the t extracted entire.

*ching or Depression.*—The object of this operation is to re- he cataract from the axis of the vision, and is performed by hing needle passed through the outer side of the sclerotica, two lines from the margin of the cornea.

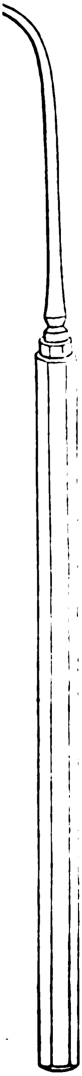
*ducing Absorption.*—The needle is introduced in the same

; black spots or flashes of light, a vacant stare, dilated
ut little motion of the eyelids, indicate amaurosis. There
ant of the natural colour of the pupil, which may cause
taken for cataract, from which it is most certain to be
d by the catoptric test, as well as by rational signs. The
s are circumstances which over-stimulate the retina, such
lights, heats, intemperance, tight neck-cloths; also in-
concussion, extravasations, tumours, &c.

*t.*—Should it be inflammatory, produced by wounds,
r exposure to intense light; or if there are plethora, head-
ess, turgid countenance, and frequent flashes of light
ing; or if the complaint has followed a suppression of
med evacuation, or the drying up of an habitual ulcer or
en the antiphlogistic treatment must be adopted,—bleed-
g, counter-irritants, and purgatives. Should it be atonic,
f a protracted illness, great loss of blood, over-lactation,
or other debilitating circumstances, it is attended with
ilated pupils, trembling pulse, and despondency of mind.
usually sees best after eating, and in a strong light. The
r other source of exhaustion should be corrected, and the
ngthened by fresh air, tonics, quinine, steel, good living,
ecretions should be well regulated, and the cutaneous
circulation be promoted by exercise and bathing.

be sympathetic, supervening on jaundice, some disorder
ach, or worms, the general health must be regulated be-
can be expected. It may arise from tumours near the
ious teeth, which should be removed. If it follow an
e fifth pair of nerves, the wound should be dilated; or

50.



childhood. Sometimes it is the *result* of imitation; or it may be induced by marks or patches on the nose; but oftener it is occasioned by gastric or intestinal irritation. Cerebral disturbance is another cause, especially when the squint does not come until adult age.

*Treatment.*—In childhood, where squinting depends on sympathetic disturbance, it is often removed by purgatives, alteratives, or anthelmintics.

Some cases of squinting may be cured by division of a muscle, but not all; in fact, a deformity sometimes results from the operation.

In almost all cases of squinting, there is defective vision in the affected eye; this defect is usually relieved when the operation is properly performed. The patient should be steadied, as for other ophthalmic operations. The eyelids are to be separated by an assistant or speculum, and the eye not to be operated on is carefully to be bandaged.

The conjunctiva is to be seized by a small toothed forceps, about midway between the cornea and the caruncle, so as to form a horizontal fold, which is to be snipped by the scissors close to the forceps, and between them and the cornea; or, this fold of conjunctiva may be divided by an iris knife. After the division, the conjunctiva is to be separated from the sclerotica for a slight distance. The third step consists in the introduction of a blunt hook, which is curved so as to accommodate itself exactly to the curvature of the eyeball. The hook is to be passed under the tendon, from above downwards; and the muscle now being secure, it is to be divided by a pair of scissors. If the pupil is now in the centre of the orbit, and if the patient cannot turn the eye horizontally inwards, the operation may be considered as complete. Should a portion of the muscle, or some tendinous fibres remain undivided, they are to be sought for by the blunt hook, and divided. If the fascia is too extensively divided, the eye will become too prominent, or an external squint will result.

After the operation cold water is all
be applied. The operated eye sh
sively used for a few days.
often rises from the wound,
by the knife, scissors, or lu

# GLOSSARY.

***Achromatopsia*** (*a*, priv. *χρῶμα*, *colour*, *ὤψ*, *the eye*), want of power to distinguish colours.

***Aegilops*** (*αἰγίλωψ*, from *αἴξ*, *αἰγὸς*, *a goat*, *ὤψ*, *the eye*), a name given by the older surgeons to a sinuous ulcer at the inner corner of the eye, from its resemblance to the *larmier*, or infra-orbital glandular sac of goats and other ruminating animals.

***Albugo*** (albus, *white*), an opacity of the cornea.

***Amaurosis*** (*ἀμαύρωσις*, *obscuration*, from *ἀμαυρόω*, *to render obscure*), impairment or loss of vision from paralysis of the optic nervous apparatus.

***Amblyopia*** (*ἀμβλὺς*, *dull*, *ὤψ*, *the eye*), impaired vision from defective sensibility of the retina.

***Amphiblestroiditis*** (*ἀμφιβληστροειδὴς*, *the retina*, from *ἀμφιβληστρον*, *a net*, and *εἶδος*, *form*), retinitis, or inflammation of the retina.

***Anchilops*** (*ἀγχίλωψ*, from *ἄγχι*, *near*, and *ὤψ*, *the eye*), name given by the older surgeons to the abscess at the inner corner of the eye, ending in the sinuous ulcer which they called Aegilops.

***Anchyloblepharon*** (*ἀγκύλος*, *crooked*, *βλέφαρον*, *eyelid*), cohesion of the eyelids to each other at their borders.

***Asthenopy*** (*a*, priv., *σθένος*, *strength*, and *ὤψ*, *the eye*), weaksightedness.

***Atresia*** (*a*, priv., *τιτράω*, *to perforate*), closure or imperforation; applied to the pupil, &c.

***Blepharitis*** (*βλέφαρον*, *eyelid*), inflammation of the eyelids.

***Blepharoblennorrhœa*** (*βλέφαρον*, *eyelid*, *βλέννα*, *mucus*, *ῥέω*, *to flow*), first stage of puro-mucous inflammation of the conjunctiva.

***Blepharophthalmia*** (*βλέφαρον*, *eyelid*, *ὀφθαλμός*, *eye*), called also Blepharophthalmo-blennorrhœa, puro-mucous inflammation of the conjunctiva in its fully-formed state.

***Blepharoplegia*** (*βλέφαρον*, *eyelid*, *πληγὴ*, *stroke or blow*), paralysis of the eyelid.

***Blepharoptosis*** (*βλέφαρον*, *eyelid*, *πτῶσις*, *a falling down*), called also simply Ptosis, a falling down of the upper eyelid.

***Blepharospasmus*** (*βλέφαρον*, *eyelid*, *σπασμός*, *spasm*), spasm of the eyelids.

***Buphthalmos*** (*βους*, *ox*, *ὀφθαλμος*, *eye*), *Oculus Bovinus*, dropsical enlargement of the eye.

***Canthus*** (*κανθος*, *the rim of a wheel*), angle of the eye.

***Cataract*** (*καταράκτης*, from *καταῤῥάσσω*, *to throw down with violence*, *to break or disturb*), opacity of the lens or its capsule.

***Ceratitis*** (*κέρας*, *horn*, *cornea*), inflammation of the cornea.

***Ceratocele*** (*κέρας*, *horn*, *cornea*, *κήλη*, *tumour*), hernia of the cornea.

***Ceratome*** (*κέρας*, *cornea*, *τομὴ*, *section*), a knife for making an incision of the cornea.

***Chalazion*** (*χάλαζα*, *grando*, *or hailstone*), a small tumour of the eyelid.

***Chemosis*** (*χήμωσις*, from *χήμη*, *a gaping*, from *χαινο*, *to gape*; or *χύμωσις*, from *χυμὸς*, *humour*, *or fluid*), elevation of the conjunctiva like a wall round the cornea, from exudation into the subjacent cellular tissue.

***Choroiditis*** (choroid, from *χόριον*, *chorion*, *one of the membranes of the fœtus*, *εἶδος*, *likeness*), inflammation of the choroid.

*omatopsy*, or *Chromopsy* (*χρῶμα, colour, ὄψις, vision*), chromatic or coloured
.

*oopsy*, or *Chrupsy* (*χρόα, colour, ὄψις, vision*), chromatic vision.

*ia* (celo, *to cover or conceal, because they cover and protect the eye*, or from
*to move*), eyelashes.

*sophthalmia* (*κιρσός, varix, ὀφθαλμός, the eye*), a varicose state of the blood-
ls of the eye.

*vus* (*the head of a nail*), a certain degree of prolapse of the iris, through an
ıg in the cornea; the prolapsed portion of the iris being pressed flat like
ead of a nail.

*lyrium* (*κολλύριον*, from *κολλύρα, a cake; bread sopped according to Scaliger*
*eing a common application to the eyes*), a medicine for the eyes.

*oboma* (*κολόβομα, mutilation*), applied to fissures of the eyelids and of th
ongenital or traumatic.

*ectomia* (*κόρη, pupil, ἐκ, out, τέμνω, to cut*), operation for artificial pupil by
ion.

*edialysis* (*κόρη, pupil, διαλύω, to loosen*), operation for artificial pupil b
ation.

*emorphosis* (*κόρη, pupil, μόρφωσις, formation*), operation for artificial pupil i
al.

*eoncion* (*κόρη, pupil, ὄγκος, hook*), hook invented for the operation for art
pupil by separation.

*eplastice* (*κόρη, pupil, πλαστική, the art of making images*), operation for art
pupil in general.

*nea* (*cornu, horn*), the cornea is so called from its horny appearance.

*otomia* (*κόρη, pupil, τέμνω, to cut*), operation for artificial pupil by incision

*rette* (*French for a small spoon*), *Daviel's* spoon, an instrument used to assi
kit of the lens in the operation of extraction.

*cryoadenitis* (*δακρύω, to weep, ἀδὴν, gland*), inflammation of the lachrym
.

*cryocystitis* (*δακρύω, to weep, κυστις, sac*), inflammation of the lachrym

*cryo-cysto-blennorrhœa* (*δακρύω, to weep, κύστις, sac, βλέννα, mucus, ῥέω*,
blennorrhœa of the lachrymal sac.

*cryohæmorrhysis* (*δακρύω, to weep, αἷμα, blood, ῥέω, to flow*), sanguineo
ymation.

*cryolites* (*δακρύω, to weep, λίθος, a stone*), calculous concretions deposited
ıchrymal passages.

*cryoma* (*δακρύω, to weep*), stillicidium lachrymarum.

*olopy* (*διπλόος, double, ὤψ, vision*), double vision.

*stichiasis* (*δὶς, twice, στίχος, a row*), a form of trichiasis in which the m
ted eyelashes form a second row, distinct from the others.

*ropium* (*'Εκτρόπιον*, from *ἐκ, out, τρέπω, to turn*), eversion of the eyelids.

*canthis* (*ἐν, in, κανθός, the corner of the eye*), enlargement of the lachryn
ıcle.

*tropium* (*ἐν, in, τρέπω, to turn*), inversion of the eyelids.

*icanthus* (*ἐπὶ, upon, κανθὸς, angle of the eye*), a congenital peculiarity of
of skin extending over the inner canthus.

*iphora* (*ἐπὶ, upon, φέρω, to carry*), watery eye from excess of lachrymal
on.

*ophthalmos* and *Exophthalmia* (*ἐξ, out, ὀφθαλμός, eye*), protrusion of t
ıll. Exophthalmos is used when the eyeball is otherwise uninjured
ıthalmia, when, in addition to the protrusion, there is disorganization of t
ıll.

*rontoxon* (*γέρων, old, τόξον, a bow*), arcus senilis.

*aucoma* (*γλαυκὸς, sea-green*), a greenish opaque appearance behind t
.

*ando* (*hailstone*). a small tumour of the eyelid.

ians to cataract, as they supposed it

*Gutta serena* (drop serene), name given by the Arabians to amaurosis, supposing it to depend on a clear drop fallen from the brain into the eye.

*Hæmophthalmos, Hæmophthalmia* ([illegible], *blood*, [illegible], *the eye*), sanguineous effusion into the eye.

*Hemeralopia* ([illegible], *day*, [illegible], *vision*), night-blindness. It has been also employed to mean day-blindness ([illegible], *day*, *a* priv., or [illegible], *blind*, [illegible], *vision*).

*Hemiopia* ([illegible], *half*, [illegible], *vision*), a defective state of vision, in which one half of objects only is seen.

*Hordeolum* (hordeum, *barley*), stye.

*Hyalitis*, or *Hyaloiditis* ([illegible], *glass*), inflammation of the hyaloid membrane.

*Hydrophthalmia*, or *Hydrophthalmos* ([illegible], *water*, [illegible], *the eye*), dropsy of the eye.

*Hyperkeratosis* ([illegible], *above*, [illegible], *cornea*), conical cornea.

*Hypoæma* ([illegible], *under*, [illegible], *blood*), blood in the anterior chamber.

*Hypochyma* ([illegible], or [illegible], from [illegible], *under*, [illegible], *effusion*), cataract.

*Hypogala* ([illegible], *under*, [illegible], *milk*), effusion of a milky-like matter in the anterior chamber.

*Hypopyon* ([illegible], *under*, [illegible], *pus*), pus in the anterior chamber.

*Iridankistron* ([illegible], *iris*, [illegible], *a fish-hook*), an instrument invented for performing the operation of artificial pupil by separation.

*Iridauxesis* ([illegible], *iris*, [illegible], *growth*), thickening or growth of the iris from exudation into its substance.

*Iridoncosis* ([illegible], *iris*, and [illegible], *tumour*), a name formerly proposed by Von Ammon for the same morbid state of the iris, as that to which he has since given the name *Iridauxesis*; but now applied to an abscess of the iris.

*Iridectomia* ([illegible], *iris*, [illegible], *out*, [illegible], *to cut*), operation for artificial pupil by excision.

*Iridectomedialysis* ([illegible], *iris*, [illegible], *out*, [illegible], *to cut*, [illegible], *separation*), operation for artificial pupil by a combination of excision and separation.

*Iridencleisis* ([illegible], *iris*, [illegible], *in*, and [illegible], *to close*), the strangulation of a prolapsed portion of the iris between the lips of an incision of the cornea in certain operations for artificial pupil.

*Iridodialysis* ([illegible], *iris*, [illegible], *separation*), the operation for artificial pupil by separation.

*Iridoschisma* ([illegible], *iris*, [illegible], *fissure*), a fissure of the iris. See *Coloboma iridis*.

*Iridotomia* ([illegible], *iris*, [illegible], *section*), the operation for artificial pupil by incision.

*Iridoperiphakitis* ([illegible], *iris*, [illegible], *around*, [illegible], *a lens or lentil*), inflammation of the iris and anterior wall of capsule of the lens.

*Keratitis* ([illegible], *horn*, *cornea*), inflammation of the cornea.

*Keratonyxis* ([illegible], *cornea*, [illegible], *a puncture*), corneal puncturation, a needle operation for cataract.

*Keratectomia*. See *Corectomia*.

*Keratodialysis*. See *Corodialysis*.

*Keratomorphosis*. See *Coremorphosis*.

*Keratoplastice*. See *Coreoplastice*.

*Keratotomia*. See *Corotomia*.

*Lagophthalmos* ([illegible], *a hare*, [illegible], *the eye*), [illegible] Retraction or shortening of either eyelid.

*Leucoma* ([illegible], *to whiten*, or [illegible], *white*), opacity of the cornea from [illegible]

*Lippitudo* (lippus, *blear-eyed*), blear eye.

*Luscitas* (luscus, *blind of one eye*), fixed misdirection of the eye.

*Madarosis* ([illegible], from [illegible], *bald*), a falling out of the eyelashes.

*Marmaryge* ([illegible], *splendour*), an appearance of sparks or coruscations before the eyes.

*Metamorphopsy* ([illegible], *to transform*, [illegible], *vision*), distorted appearance of objects.

*hthalmos* (μικρὸς, *small*, ὀφθαλμὸς, *the eye*), smallness of the eye from im-
evelopment.

*y* (μικρὸς, *small*, ὄψις, *vision*), a state of vision in which objects appear
han natural.

*n* (*a millet seed*), a small white tumour of the eyelids or their neighbour-

*lepsis* (μόνος, *single*, βλέψις, *view*), state in which vision is distinct only
e eye is used.

*ele* (μύξα, *mucus*, κήλη, *a tumour*), dropsy of the lachrymal sac.

*volitantes* (musca, *a fly*, volito, *to fly about*), the appearance of grayish
fore the eyes.

*usis* (ἀμυδρὸς, *obscure*, or μυδάω, *to abound in moisture*, because it was
l to be owing to redundant moisture), preternatural dilatation of the

*phalon* (μυῖα, *a fly*, κεφαλὴ, *the head*), a small protrusion of the iris, like a
d, through an ulcerated opening in the cornea.

*sopsia* (μυῖα, *a fly*, ὄψις, *vision*), muscæ volitantes.

*y* (μύω, *to shut*, ὢψ, *the eye*), nearsightedness.

*is* (μύω, *to shut*), preternatural contraction of the pupil.

*my* (μῦς, *a muscle*, τέμνω, *to cut*), section of muscles. Ocular myotomy,
f muscles in strabismus.

*lopia* (νὺξ, *night*, ὄψις, *vision*), day-blindness. Employed also for night-
s (νὺξ, α priv., or αλαος, *blind*, ὄψις, *vision*).

*gmus* (νυσταγμὸς, *sleep*), oscillation of the eyeball.

*s Bovinus* (bos, bovis, *an ox*), ox-eye; see *Buphthalmos*.

*s Leporinus* (lepus, leporis, *a hare*), hare's eye; see *Lagophthalmos*.

(ὄνυξ, *a nail*), deposition of matter in the substance of the cornea.

*almia* (ὀφθαλμὸς, *the eye*), a general name for inflammation of the eye.

*almia Neonatorum* (νέος, *young*), purulent ophthalmia of new-born in-

*almitis*, inflammation of the whole eyeball.

*almodynia*, (ὀφθαλμὸς, *eye*, ὀδύνη, *pain*), pain in the eye.

*almology* (ὀφθαλμὸς, *eye*, λόγος, *a discourse*), the science of ophthalmi
and surgery.

*almoplegia* (ὀφθαλμὸς, *eye*, πληγὴ, *a blow or stroke*), paralysis of the mus
e eyeball.

*almoptosis* (ὀφθαλμὸς, *eye*, πτῶσις, *a falling down*, from πίπτω, *to fall*), th
n of the eyeball, resulting from paralysis of its muscles.

*ia* (ὀξὺς, *sharp*, ὢψ, *the eye*), preternatural acuteness of vision.

*blephara*, *Pachytes* (παχύτης, *thickness*, from παχὺς, *thick*, βλέφαρον, *eyelid*
nent and thickening of the eyelid.

*ræ* (a palpitando, *from their frequent motion*), the eyelids.

*s* (pannus, *cloth*), a thickened and vascular state of the conjuucti

*rbita* (περὶ, *over*), the periosteum of the orbit.

*tenula* (φλύκταινα, *a vesicle*, from φλύζω, *to gush forth*), vesicle filled wi
fluid.

*hobia* (φῶς, *light*, φοβέω, *to dread*), intolerance of light.

*sia* (φῶς, *light*, ὄψις, *vision*), subjective appearance of light before t

*iriasis* (φθειρίασις, *morbus pedicularis*, from φθεὶρ, *a louse*), pediculi amo
ashes and hairs of the eyebrows.

*ecula* (pinguis, *fat*), a small tumour on the white of the eye near t
he cornea, apparently but not really adipose.

*rotes* (πλαδαρὸς, *flaccid*), thickening of the palpebral conjunctiva.

*yopy* (πρέσβυς, *old*, ὢψ, *the eye*), farsightedness.

*osis* (πρὸ, *before*, πτῶσις, *a falling down*, from πιπτω, *to fall*); see *Ophth*

*phthalmia* (ψώρα *scabies*, ὀφθαλμὸς, *the eye*), ophthalmia tarsi.

*gium* (πτερὸν, *a wing*, πτερύγιον, *a small wing*), thickened and vascular st of a portion of the conjunctiva, of a triangular shape, the apex encroaching more or less on the cornea.

*Ptilosis* (πτίλωσις, *bald*), falling out of the cilia; see *Madarosis*.

*Ptosis* (πτῶσις, *a falling down*, from πιπτω, *to fall*), falling down of the upper eyelid.

*Pupil* (*pupilla*), the aperture in the iris.

*Retinitis* (rete, *a net*), inflammation of the retina.

*Rhexis*, or *Rhegma Oculi* (ῥῆξις and ῥῆγμα, *a rupture*), rupture of the eyeball.

*Rhytidosis* (ῥυτίδωσις, *a wrinkling*, from ῥυτιδόω, *to wrinkle*), collapsed or contracted state of the cornea.

*Sclerotitis* (σκληρός, *hard*), inflammation of the sclerotica.

*Scotomata* (σκότωμα, *dizziness*, from σκοτόω, *to darken*), dark spots seen before the eyes; see *Muscæ Volitantes*.

*Staphyloma* (σταφυλή, *a grape*), a projection of some part of the eyeball, generally of the cornea and the iris, or sclerotica and choroid.

*Staphyloma Racemosum* (racemus, *a bunch of grapes*), staphyloma is so called when there is an appearance of several projections.

*Stenochoria* (στενοχωρία, *narrowness of space*, from στενός, *narrow*, χῶρος, *space*), a contraction, applied to the derivative lachrymal passages.

*Stillicidium* (stillo, *to drop*, cado, *to fall*), dropping of tears from the eye, in consequence of obstruction of the derivative lachrymal passages.

*Strabismus* (στραβίζω, *to squint*, from στραβός, *twisted*), squinting.

*Symblepharon* (σὺν, *together*, βλέφαρον, *eyelid*), adhesion of the eyelids to the eyeball.

*Synchesis* (σύγχυσις, *mixture*, from σὺν, *together*, and χέω, *to pour*), dissolution of the vitreous body.

*Synechia* (συνέχεια, *continuity*, from συνέχω, *to keep together*), adhesion of the iris to the cornea or capsule of the lens; in the former case it is distinguished as anterior synechia, in the latter as posterior synechia.

*Synizesis* (συνίζησις, *a falling together*, from συνίζω, *to set together*), closure of the pupil.

*Tarsoraphia* (ταρσος, *tarsus*, ῥαφή, *a suture*), suture of the tarsal margins in ectropium of the external angle.

*Taraxis* (τάραξις, *disturbance*, from ταράσσω, *to disturb*), slight external ophthalmia.

*Trachoma* (τραχωμα, *roughness*, τραχόω, *to make rough*), granular conjunctiva.

*Trichiasis* (θρίξ, *a hair*), inversion of the eyelashes.

*Trichosis* (θρίξ, *a hair*), *Trichosis Bulbi*, a small tumour on the front of the eyeball, with hair growing from it.

*Tylosis* (τύλος, *callosity*), thickening and induration of the borders of the eyelids.

*Xeroma*, *Xerophthalmia*, *Xerosis* (ξηρὸς, *dry*), dryness of the eye, of which there are two kinds, viz., conjunctival and lachrymal.

THE END.

# HAND-BOOK

# OBSTETRICS

A

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# OBSTETRICS:

With Forty-One Illustrations.

BEING A PORTION OF

AN ANALYTICAL COMPENDIUM

OF THE

VARIOUS BRANCHES OF MEDICINE.

BY

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# OBSTETRICS.

## OF THE BONES OF THE PELVIS.

The pelvis is an irregular bony cavity, situated at the base of the spinal column, and above the inferior extremities, with which it is connected by muscles and articulations, and for which as well as for the muscles of the trunk, it constitutes "a point d'appui."

When divested of its soft structures, this organ somewhat resembles a basin, and hence its name; for the Greeks called it πελυξ, a wooden utensil of bowl-form; the Latins from them derived the word *pelvis*, which is the term generally adopted by English and American writers. The French call it *le bassin*, the Italians *el bacino*,—all which words have the same signification.

In the adult, the pelvis consists of four parts, viz.: two *ossa innominata*, the *os sacrum*, and the *os coccygis*, but in early life they are more minutely divisible.

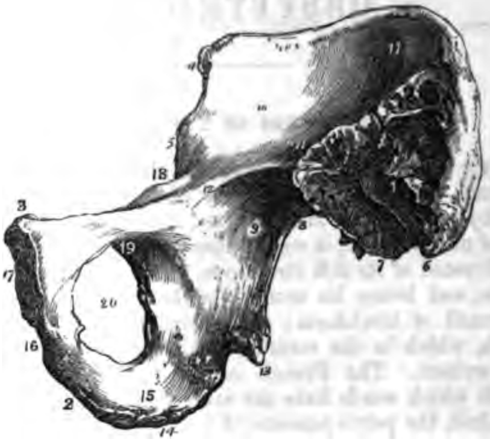
Each *os innominatum* at an early period of intra-uterine life consists of cartilage only. Subsequently bony depositions take place, which at birth have coalesced so as to form three bones separated by cartilage, viz.: the *Ilium*, the *Ischium*, and the *Pubis*. The process of ossification continues till these three bones meet in the acetabulum, two-fifths of which are formed by the ilium, two-fifths by the ischium, and one-fifth by the pubis.

The breadth of each *os innominatum*, from the *anterior superior spinous process* to the *posterior superior spinous process* is six inches, and the height from the *tuber ischii* to the *crest of the ilium*, is seven inches.

*Os ilium, hip*, or *haunch bone* (Fig. 1), is the largest of the three divisions of the *os innominatum*, and is uppermost in position. It has an *outer* and an *inner surface*; the *outer*[1] is called *dorsum*, and is irregularly convex, and marked by eminences and depressions affording attachments for the glutæi muscles. The *inner*[10] is concave and smooth; and is called *venter*; it is occupied by the iliacus internus muscle. The *lower* portion, the *base*, or *body*,[5] is the thickest part of the bone, and enters largely into the composition of the acetabulum, a cavity for the reception of the head of the femur. Just above the base, the bone narrows into a kind of neck, from which [illegible] wing. The ala terminates superiorly in a ridge [illegible] whole extent, called the *crista ilii*, or crest of the

To different parts of the *crest* **are attached the oblique and** ɜrse abdominal muscles, the **latissimus dorsi, the erector** and the quadratus lumborum. **It terminates *anteriorly* in**

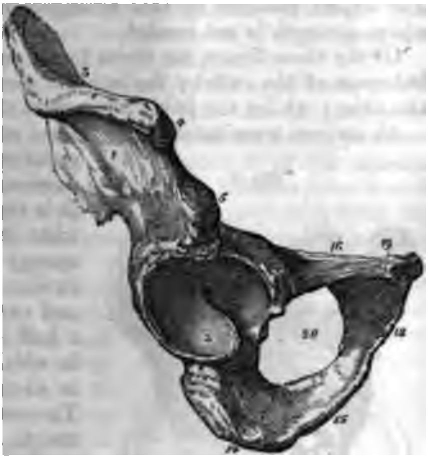
Fig. 1.



*terior superior spinous process*, and *anterior inferior spinous* s,[4] [5] and posteriorly in the *posterior superior* and *inferior spi-* ›*rocesses.*[6] [7] The *anterior superior spinous process* gives attach- to one end of *Poupart's* or *Gimbernat's* ligament, the *tensor* *v femoris*, and the *sartorius muscles.* From the anterior infe ises the longer portion of the rectus femoris. Into the *posterio* ɜerted strong ligaments, which bind this bone very firmly t crum. Below the posterior inferior spinous process there is ı ırch, the *sciatic notch*, which is divided by ligaments into th *iatic foramina;* through the *upper*, which is the larger, pas uteal, sciatic and pudic arteries, the sciatic and pudic nerves ıe pyriform muscle; through the *inferior*, the pudic arterie erve re-enter the pelvis, and the obturator internus muscl out. The posterior part of the crest is very rough, and mark nnexion between the ilium and sacrum, called the *sacro-ilia* *ysis*, of which there is one on each side of the sacrum. Th ɔf the bone is divided from the ala internally by a ridge run ıorizontally,[12] forming a portion of the *pelvic brim*, *linea inn* *a*, or *linea ilia.* The ilium is connected with the ischium an in the acetabulum, and posteriorly with the sacrum.

*ischium*, is the second in size, and lowest in position of th ›ns of the innominatum. It is noted for a *base* or *body*, *ts process*, its *tuberosity*, and *ascending ramus.* The base, body (Fig. 2[9]), forms the inferior portion of the acetabulum, and is the thickest part. Below this is a narrowed portion called the *neck*; from this a pyramidal process juts out called the *spine*, or *spinous process*, affording attachment to part of the *sacro-sciatic* ligament. It varies in length and direction, and is at times of importance obstetrically, from the impediment which it occasionally offers to the descent of the child's head. In its descent from the neck, the bone bulges out into a protuberance called *tuber ischii*,[14] and turning upwards at an acute angle, becomes the *ascending ramus of the ischium*.[15] The internal surface of this bone is smooth and even, and forms one of the *inclined planes* of the pelvic cavity; the external is rough, and gives attachment to the sacro-sciatic ligament, and several muscles. The ischium is connected with the ilium and pubes in the acetabulum, and articulated with the sacrum by ligaments.

Fig. 2.

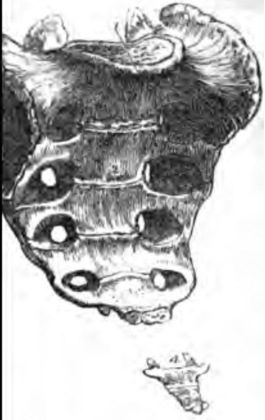


*Os pubis*, is the smallest and most anterior of the three divisions. It has a *base*, a *body*, two *rami*, a *horizontal* and a *descending*, a *spinous process*, and a *symphysis*. Its *base* is the thickest part, and forms the *anterior* and *smaller portion* of the acetabulum, beyond which the bone narrows, and proceeding forwards forms the *horizontal ramus* (Fig. 2[16]). This terminates in a wider sheet, and its edge, the point of junction with its fellow bone, is called the *symphysis pubis* (Fig. 1[illegible]). From the inferior part of the symphysis, the *descending ramus* (Fig. 2[15]) proceeds downwards to meet the ascending ramus of the ischium, and with it forms one side of the *arch of the pubis*. On the interior, running along the upper margin of the horizontal ramus, is a ridge, called the *crest* of the pubis, or the *linea pectinea*, which, by its junction with the *linea ilia*, forms the *linea ilio pectinea*, and at its pubic extremity is a small ous process, affording an attachment to the pubic end of *Pou-* *'s ligament*; whilst the inner and outer edges of this portion of rtion to the abdominal muscles. The os pubis is ilium and ischium in the acetabulum, with the of the ischium, and with its fellow, by the sym-

. In the *anterior part* of the os innominatum is seen the
*tor foramen*,[20] formed by the ischium and pubis, which is
filled in the recent state by the obturator ligament; through
le at the superior part pass the obturator vessels and nerve.
bject attained by this arrangement is lightness of structure
strength is not needed.

the three bones, the ilium forms part of the brim of the pelvis
ne of the outlet; the ischium part of the outlet, but none of
im; whilst the pubis forms part of both brim and outlet.

Fig. 3.



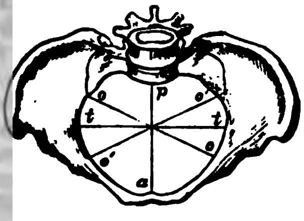
*sacrum* terminates the vertebral column; in form it is triangular with the apex of the pyramid downwards, and rather backwards. It is the lightest bone in the body when its size is considered, and is spongy in structure. It has *four* surfaces, an external and internal, and two lateral, is about four and a half inches in length, four inches in width, and its greatest thickness is about two and a half inches. The *external surface* is convex and rough, and has three or four processes like those of the vertebræ which may be called *the spinou*
*processes of the sacrum;* anterio
to these we find a hollow cavity fo
the reception of the *cauda equina*
with four holes on each side, whic
communicate with the cavity, fo
the transmission of nerves. Th
*al surface* (Fig. 3 [2]) is smooth and concave to the depth c
n inch, and crossed by four transverse white lines, which mar
rmer division of its bones by cartilage. There are also fou
of holes on this surface, which transmit nervous filament
afterwards form part of the great sciatic nerve. The upp
f this bone completes the brim of the pelvis, and from th
tion of the central part it is called the *promontory of t*
*n*.[1] The *lateral surfaces*[3] are rough and uneven, the i
rities corresponding with those on the ilium, and formi
hem the *sacro-iliac symphysis.*

*occygis*, is attached to the apex of the sacrum, and is so nam
its resemblance to the beak of a cuckoo.[4] It is compos
ee or four pieces, which play upon each other by separa
and is of much importance in obstetrical study. The less
ligament and the ischio-coccygeal muscles are inserted into
*isions of the pelvis.*—The pelvis is divided into the true a

false; the upper and the lower; and the greater and the lesser, by the *linea ilio-pectinea*, all above that line being the upper, the greater, or false pelvis, all below receiving the other denominations. The *upper pelvis*, or *pavilion*, is completed by the abdominal muscles, the ilio-lumbar ligament, and the last two lumbar vertebræ. The *lower* or *true pelvis* is of the most importance to obstetricians, and is divided into *brim*, *cavity* or *excavation*, and *outlet*.

The *brim* or *superior strait*, is defined by the symphysis pubis, the horizontal portion of the body of the pubis, the spinous process of the pubis, the linea pectinea, the ilio-pectineal eminence, the linea ilia, the sacro-iliac symphysis, and the promontory of the sacrum, and is shaped like the heart on a playing card. It has *three diameters*, an *antero-posterior*, called also, *straight* or *conjugate*, from the promontory of the sacrum to the inner edge of the symphysis pubis, which measures about four inches. (Fig. 4, *a*, *p*.) The *transverse*, across the widest part of the brim, and at right angles to the antero-posterior, is about five inches, and a quarter.(*t t*) The *oblique*, from the *sacro-iliac junction* on either side to the opposite side of the brim above the acetabulum, five inches.(*o o*)— These measurements are of course less in the living body in consequence of the presence of the soft structures. The circumference of the brim is about thirteen inches.

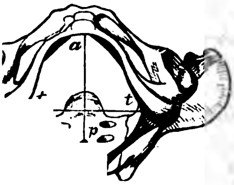
Fig. 4.



The true pelvis is the *cavity* or *excavation* included between the *brim* and the *outlet*, or between the superior and inferior straits. It is an inch and a half deep in front, three and a half at the side, and five inches from the sacral promontory to the tip of the coccyx. The cavity of the true pelvis resembles a bent cone in shape, and its orifices being somewhat narrowed are called *straits*. A line drawn from the inferior part of the symphysis pubis to the promontory of the sacrum, measures four and a half inches; from the same point to the hollow of the sacrum, four and three-quarter inches. The oblique measurement of the cavity from the tuber ischii to the sacro-iliac junction, measures six inches.

The *outlet*, or *inferior strait*, is of an irregularly oval shape, and its diameters are the reverse of those of the superior strait; thus, the antero-posterior diameter, from the arch of the pubes to the tip of the coccyx, is four to four and a half inches. (Fig. 5, *a*, *p*.) The transverse, from one tuberosity to the other, is four inches (*t t*). The outlet is bounded by the tip of the coccyx at the back, by the under fasciculus of the sacro-sciatic ligaments lly, by the tubera ischii at the sides, by the f the ischia and pubes anteriorly and laterally, and by the symphysis pubis in front. Its circumference is about twelve inches.

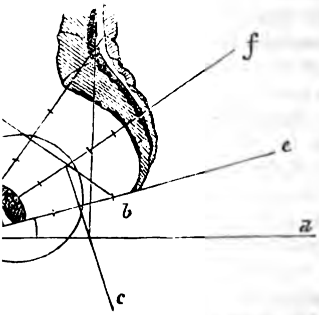
Fig. 5.



*The planes of the straits.*—If a piece of card or paper be cut so as to fit within the anatomical boundary of the superior strait, it will represent the *plane* of that *strait.* Now hold the pelvis in the position it occupies when the individual is either sitting or standing, and it will be found that the plane of the strait has an tion of about thirty-five degrees, which may be increased or hed at will by extending or flexing the lumbar vertebræ. ne of the *inferior strait* may also be described in the same z.: by fitting a card into it. It will be found that they incline each other anteriorly, and would meet, if produced, about l a half inches in front of the pubes. The whole position of vis in regard to the trunk of the body is *oblique,* so that a wn through the trunk in the direction of its axis would, in downwards, strike on the centre of the symphysis pubis.

*of the pelvis.*—There are two axes of the pelvis, one of the superior strait, which is a line drawn perpendicular to the f that strait, and, if produced, would extend from the coccyx ttle above the umbilicus; the other, of the *outlet* or *inferior* which is a line drawn perpendicular to the plane of that nd, if produced, would extend from the promontory of the to the central space between the tubera ischii. The axes of er and lower straits of the pelvis form an obtuse angle with her. By combining these axes with the inclination of the ve can obtain a correct notion of the *direction* of the *canal* of the *pelvis,* which, it will be readily seen, is curved. By having a correct knowledge of the axes of the trunk and pelvic entrance, the obstetrician is enabled to place his patient in the position most favourable to the ready descent of the child's head through the brim into the excavation. The direction of the axis of the pelvis will be better understood, perhaps, by a description of "*Carus' curve.*" If one leg of a pair passes be set on the posterior edge of the symphysis pubis

Fig. 6.



in a bisected pelvis, and the other one be opened two and a quarter inches, a circle may be drawn through *g f*, *g e*, *g d*, (Fig. 6,) to the point of departure. This circle will represent Carus' curve, and will very nearly coincide with the axis of the pelvis. As the child's head moves through the excavation, its central point coincides with this curve, and if the head of the child should continue after birth to move in the same curve it followed while in the pelvis, it would come back to the point of departure at the centre of the plane of the superior strait. But if the head depart from the coincidence with this curve, either in an unassisted or an instrumental labour, the soft parts of the mother will be greatly endangered. Fig. 6 represents "Carus' curve."

*The inclined planes of the pelvis.*—These are four in number, an *anterior* and a *posterior* on the right side, and an *anterior* and *posterior* on the left side. To demonstrate them, let two vertical cuts be made through the lesser pelvis, and at right angles to each other. The first should be made through the symphysis pubis, and the median line of the sacrum and coccyx, and the second, or transverse, should commence behind the tuberosity of the ischium on either side, and run upwards perpendicularly through the apex of the spine of the ischium, intersecting the *linea ilia* three-quarters of an inch in front of the sacro-iliac symphysis. The direction of these inclined planes is such, that the child's head moving on them will necessarily rotate either under the symphysis pubis, or into the hollow of the sacrum. By these two vertical cuts there will be an *anterior* and *posterior* inclined plane demonstrated on each side of the pelvis, of which the anterior will be the longer.

*The muscles within the pelvis* deserve notice; for, by being pressed on during the escape of the child's head, they are sometimes strained, and pain is experienced in moving the thigh, and in evacuating the rectum, for some days subsequent to labour. *The levator ani*, one on each side, of the shape of a fan, rises from the pubes just below the brim, the aponeurosis covering the obturator internus, and the spinous process of the ischium, passes down by the side of the vagina, and is inserted into the sphincter ani. On dissecting away these fibres, we observe the *obturator internus;* which, taking its origin from the inner surface of the obturator ligament, and a portion of both the pubes and ischium in the neighbourhood of the foramen, sends off a tendon, which, running round the ischium like a pulley, passes out of the pelvis through the smaller sacro-sciatic foramen, and is inserted into the fossa trochanterica oot of the trochanter major. *The pyriformis* arises from the r surface of the second, third, and fourth divisions of the escapes from the pelvis through the larger sacro-sciatic foramen, lso inserted into the fossa trochanterica, near the in- urator. *The coccygeus* springs from the spinous hium, and is attached to the side of the coccyx

;h nearly its whole extent. *The transversus perinei* rises from de of the tuber ischii, and is lost upon the sphincter ani, ter vaginæ, and the structure of the perineum itself.

*'erence in Form between the Male and Female Pelvis and on.*—On comparing the male and female pelves together, we ; but remark a striking difference in the general appearance articular proportions of this organ in the two sexes. We e that the pelvis of the female is altogether larger and more ;ely shaped than that of the male; that the alæ of the ilia . themselves widely in the lateral direction; while the same .n the male rise more perpendicularly upwards. The brim is ntly shaped; the long diameter in the female being from side ; in the male from before backwards. The cavity is considesmaller in the male, deeper, and more of a funnel shape, the a being much straighter, and the tuberosities of the ischia .ng closer together. The outlet is also far less capacious; and rises principally from the approximation of the ischia, which ı are more than three inches distant at the widest diameter. :ch of the pubes is formed more angularly than in the female, om this part approaches nearer to the perfection of an arch. female, too, the rami of the ischia and pubes are smoother :ir inner surface, and their anterior edge is turned more out- The disposition of the rami helps to enlarge the outlet, ives an elegance to the whole organ that is wanting in the of the stronger sex.

the bones of the male skeleton are firmer and heavier than .re in the female, and more powerfully marked by those irreties which indicate muscular attachments. The thoracic cavity ıparatively larger, and the acromia are at a greater distance :ach other. A line drawn from the head of the humerus, ıdicularly downwards, would fall to the ground altogether clear pelvis; but in a well-articulated female skeleton, the same ould rest within the ala of the ilium. It is this difference ives the broad shoulders to the male, and the swelling hips to male, and occasions the principal distinction in the outline of rm between the sexes.

## OF THE FŒTAL HEAD.

: head is of an oval shape, and largest at its occipital extre- so that in vertex presentations the largest end necessarily ıds first, and its smallest circumference, which is about ter half inches, will be nearly parallel to the successive planes of nal. It is the largest part of the child, and its lateral and or parietes are most compressible. The bones of the head require our study are the two *parietal*, the *frontal*, which ided into two, the *occipital*, and the two *temporal*, for : e description of which see ANATOMY. The bones of th child's head are not dove-tailed into each other as we find them in the adult, but are separated to some extent by intervening lines and spaces of membranous formation; the lines are called *sutures*, the spaces *fontanelles;* from their having been supposed to distil a moisture, they are also called *bregmata*, from βρέχω, to moisten. The sutures are the *coronal*, *sagittal*, *lambdoidal*, and *squamous*. At the two extremities of the sagittal suture are the two fontanelles, the *anterior* and *posterior*, named from their position. The anterior is the larger, and is of a quadrangular shape; it is formed by the rounding off of the four corners of the two frontal and the two parietal bones. The posterior is triangular, and formed by the union of three bones, the superior posterior angles of the two parietal, and the upper angle of the occipital. A knowledge of these fontanelles is of great importance in the practice of midwifery, as they are the chief means of diagnosticating the position of the child's head in labour. The great advantage gained from this arrangement of the child's head, is that it allows a more uniform growth and development to the brain than could have taken place had the cranium been solid, and what is perhaps of greater importance, it allows the bones to overlap, and thus permits a certain amount of compression, which enables the head to be pushed through a smaller space than if it had been formed of one continuous piece.

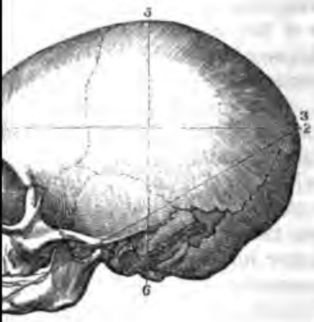
The dimensions of the fœtal head have been variously stated by obstetrical writers, each basing his report upon the result of his own observations. The following table is the best average.

| | |
|---|---|
| The longitudinal or occipito-frontal diameter, Fig. 7,[1] [2] is from . . . . . | 4 in. to 4½ in. |
| The transverse or bi-parietal, from one parietal boss to the opposite . . . | 3½ to 4 |
| The occipito-mental, or oblique,[3] [4] . | 5 to 5½ |
| Cervico-bregmatic,[5] [6] drawn from a point midway between the foramen magnum of the occipital bone and the external occipital cross to anterior fontanelle, . . . . . | 3½ to 4 |
| Bi-parietal, . . . . . . | 3½ to 4 |
| Trachelo-bregmatic, from the basilar process to the front part of bregma, . . . | 3½ |
| Fronto-mental,[7] [8] . . . . . | 3 |
| Bi-malar, . . . . . . | 2½ |
| Bi-temporal, . . . . . | 2¼ |
| Sagitto-mental, from chin and middle of sagittal suture, . . . . . . | 4¾ |
| Cervico-frontal, from midway between occipital cross and foramen magnum to forehead, . | 4 compressible to 3 |
| The fronto-mental,[7] [8] . . . . | 3 to 3½ |
| The transverse diameter of the shoulders, . | 4 to 5 reducible to 3 |
| " " " " hips, . | 4 to 5 |

In general, it may be observed that all the measurements are larger in male than in female children.

*ions of the head.—Vertex.* A circle of an inch and a half in around the posterior fontanelle as a centre. *Top of the* —Sometimes called the bregmatic region; besides which the *lateral, chin, face, forehead, base,* are used to define different is of the head which may present. By the *base* is understood e immoveable parts of it, viz.: the sphenoid in the centre, the temporal bones laterally, together with the bones of the face. The *anatomical* base is incompressible, the *obstetrical* base is compressible.

Fig. 7.

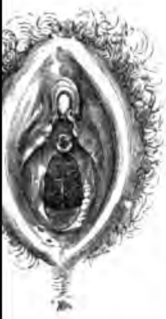


It is generally remarked that the skull of the male child is a little larger in all its diameters than that of the female. Of sixty male and sixty female children, born at full time, Dr. Jos. Clarke found the average circumference of the head to be 14 inches in the males; 13⅝ths in the females. The arch, from ear to ear over the crown, ⅛th in the males, 7 th in the females. Of the 120 examined, six exceeded 14½ inches round, and all these were males.

### OF THE ORGANS OF GENERATION.

ese are generally divided into the *external* and *internal.* The nal consist of the *mons veneris, labia externa, perineum, cli- nymphæ, vestibule, meatus urinarius, hymen* in virgins, and *culæ myrtiformes* in matrons. The internal are the *vagina, uterus,* and *uterine appendages,* which latter are the *broad ligaments, round ligaments, two ovaries,* and *two Fallopian tubes.*

Fig. 8.



The *mons veneris* (Fig. 8) is placed at the lower part of the abdomen, and uppe part of *symphysis pubis;* it consists o dense fibro-cellular, and adipous tissue, and is covered, in the adult, with hair, amon the roots of which are numerous sebaceou follicles.

The *labia externa* are two folds of ski and mucous membrane, which commence i front of the symphysis pubis, and exten downwards and backwards to the perineum where they again meet. The superior junction is called the *anterior commissure* c the vulva, the posterior, is called the *posterior commissure.* Their texture is principally *cellular* and *vascular*, and their use is to protect the organs situated between them. The *perineum* extends from the lower union of the labia externa backwards towards the anus. It is composed principally of highly distensible cellular tissue, but does not possess a great deal of fat, and the skin is very scantily supplied with hair; it is somewhat triangular in shape, and its medium breadth in women who have not borne children is from an inch to an inch and a half, being narrower, of course, in women who have. It is capable of great distension.

The *nymphæ, labia interna* vel *minora,* arise from nearly the same point, at the anterior commissure, and run downwards and backwards about an inch, to the middle of the orifice of the vagina, where they are lost in the general lining of the labia externa. They are covered with mucous membrane, and consist of cellular and erectile vascular tissue, and do not disappear during the distension of the external parts by the escape of the child's head.

The *clitoris* is seated just below the point of junction of the nymphæ, and is the analogue of the male penis, excepting that it has no corpus spongiosum, and no urethra; it is erectile, and extremely sensitive.

The *vestibule* is a triangular space, bounded superiorly by the clitoris, and laterally by the nymphæ; it is covered by smooth mucous membrane, and at its lower portion we find the orifice of the urethra, easily recognised by its soft, prominent, circular rim.

The *urethra* is about an inch and a half long, dilatable, and extends from before backwards and upwards, running under and behind the symphysis pubis.

The *hymen* is a fold of mucous membrane, generally of a crescentic shape, with its concavity upwards, which is found just within the orifice of the vagina; it is generally ruptured at the first sexual intercourse, and its remains constitute what are known as the *carunculæ myrtiformes.* The space between the hymen and the fourchette is called the *fossa navicularis.*

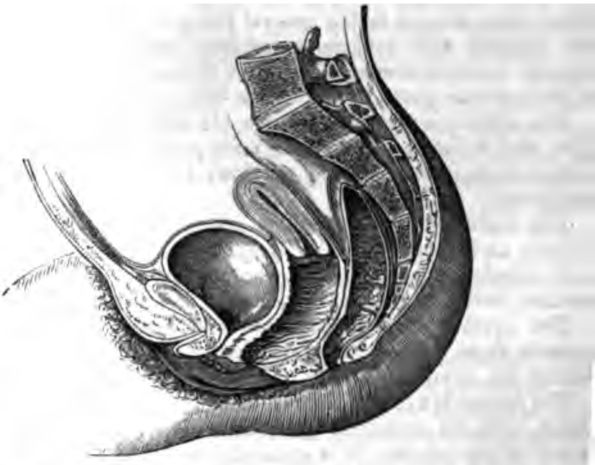
The *external organs* in the aggregate are often spoken of under the name *pudendum.*

## THE INTERNAL ORGANS.

The *vagina* is a musculo-membranous canal, extending from its origin in the vulva obliquely through the cavity of the pelvis to the uterus in its progress describing a curve, which is greater even than
the sacrum and coccyx, having the neck of the bladder, the
and the symphysis pubis anteriorly, and the rectum poste-
It is about four or five inches long; and three in circum-
d more capacious in those who have borne
coats, an external cellular, a middle mus-

and internal mucous. It is well supplied with blood-vessels, are much multiplied and interlaced at its anterior extremity, tuting what is known as the *plexus retiformis.* Its mucous rane is of a pink colour, and is arranged in transverse rugæ orly and posteriorly, which allow great distension of the vagina. ifice is surrounded by a collection of muscular fibres, called the *ter vaginæ.* It is not much under the control of the will, er, as is shown by the inability to retain injections. At its or and posterior portion, it receives a reflection of peritoneum. 9.)

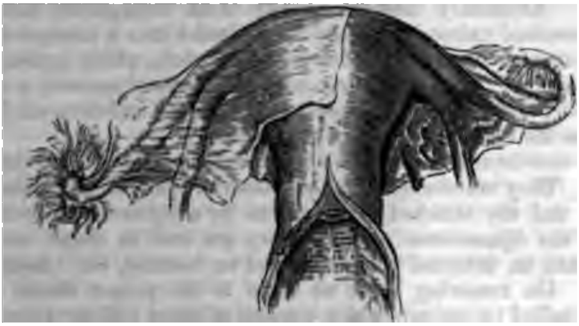
Fig. 9.



*uterus* is placed at the upper part of the vagina, and hangs centre of the pelvis behind the bladder and before the rectum, its long diameter parallel to the axis of the superior strait, and perior edge a little above the brim of the pelvis. As the axis vagina is nearly parallel with that of the inferior strait, it the axis of the uterus at an obtuse angle; any deviation from , implies a displacement of the womb. It is a hollow pear d body, rounder posteriorly than anteriorly, about 2½ to long, 2 inches wide, and very nearly an inch thick. Anato divide it into fundus, body, and neck. The fundus is tha n above the Fallopian tubes, the cervix is the inferior, cylin portion, and the body is that part between the fundus an . (Fig. 10.)

uterus has three coats, a serous, a muscular, and a mucous covered anteriorly and posteriorly by peritoneum, which is r flected laterally to the sides of the pelvis, near the sacro-iliac symphysis, forming the *broad ligaments*, which serve to steady the uterus. The *middle coat* of the uterus is muscular, and classed among those muscles which are called *non-striated*, and which are also found in the middle coats of the arteries. There are three sets of fibres, circular, longitudinal, and oblique, which, by their contraction, tend to diminish the cavity and expel the contents of the uterus. The amount of muscular fibres is much increased during pregnancy.

Fig. 10.



The *internal coat* is generally considered to be a mucous membrane, though there are some obstetrical physiologists who deny it. It extends down into the cervix, whence it is continuous with that of the vagina; it also lines the Fallopian tubes. Its colour is a pale pink except during menstruation. The uterus is supplied with blood by the spermatic and uterine arteries, and with *nerves* from the *aortic plexus*, and from the *hypogastric nerves* and *plexus*, being a mixture of sacral and sympathetic nerves. The *cavity* of the uterus is triangular, its base being directed upwards, and the superior angle corresponding to the points where the Fallopian tubes enter it; in size it is about equal to a split almond, and the internal walls are nearly always in contact. Its inferior angle communicates with the vagina through the canal of the cervix, which is barrel-shaped, and from half to three-quarters of an inch long. The contraction at the upper extremity of the canal is called the *internal os uteri*, whilst that at the lower extremity is called the *os uteri* or *os tincæ;* the latter name from its supposed resemblance to the mouth of the tench. The *shape* of the os uteri varies, in some being transverse, and in others circular, or ragged; the latter especially in women who have borne children. In the mucous membrane of the cervix are found the *glandulæ Nabothi*.

The *broad ligaments* of the uterus are two duplicatures of peri-

, one on either side, extending from the sides of the uterus
ilia, in the line which divides the anterior from the posterior
d planes of the pelvis; they act as *stays* to the uterus and
the *Fallopian tubes*, which run along their upper margin,
e *ovaries*, which are enclosed in a posterior fold.

*Fallopian tubes* are two cylindrical canals, about four inches
hich arise from the superior angle of the uterus. They open
*ly* into the uterus, at which point the canal narrows; it after-
expands, and again contracts at the point where it opens into
lomen. In the unimpregnated state it is about the size of a
Externally they are equally thick throughout, except at
erminal extremity, where they expand into a trumpet-shaped
ement, called *fimbria*, or *morsus diaboli*, which applies itself
ovary. They have three coats, an *internal mucous*, a *middle*
*ar*, and an *external serous*, or *peritoneal*, and they are looked
s the excretory ducts of the ovaries.

*ovaries* are two in number, and are the analogues of the male
They are situated on the posterior face of the broad liga-
and are attached to the uterus by a ligament of their own,
the *ligamentum ovarii*. They are oval in shape, and have
ats, an external peritoneal, and an internal, the tunica albu-
On removing these we come to the proper tissue of the
called its *stroma*, which consists of dense cellular tissue, con-
within its meshes or areolæ, numerous little vesicles named
*ian vesicles*. These vary in number and size, the largest
generally seen near the surface of the ovary; they are found
n life, but are more developed about the period of puberty.

Graafian vesicle has two coats, an *external*, the *tunic of th*
and *internal*, the *ovisac* (Barry). Within the cavity forme
se membranes is found, floating in an albuminous fluid, th
or *egg*, which is exceedingly small, and resembles in all it
the egg of the chick. The ovum also contains within it
e or membrane, which is called the yolk membrane, a granula
ermed the *yolk*, and in the centre of the yolk a little vesicl
*minal vesicle*, and on the walls of the germinal vesicle it
s is seen, named the *macula germinativa*, or germinal spo
h Graafian vesicle rises to the surface of the ovary it burst
lows the contained ovum to escape, which is seized by th
e of the Fallopian tube, and transmitted to the uterus. Th
of the Graafian vesicle (which still remains in the ovary
es filled up with a new deposit, which, being of a yello
is called from that circumstance, *corpus luteum*, or *yello*
There is no correspondence between the number of corpo
ound in the ovaries of a woman, and the number of childr
y have borne, as ova are being constantly discharged irrespe

tive of fecundation, hence the corpus luteum is no evidence of previously existing pregnancy.

## MENSTRUATION AND ITS DISEASES.

By the term *menstruation*, is understood that function in the female economy by which a certain amount of sanguineous fluid is eliminated by the uterus, and discharged from the vagina every month. This discharge, from its occurring at this regular interval, is called the *menses*, or *catamenia*, and the female in whom it so takes place is said to be *regular*.

This function generally commences at the age of puberty, which in this country is about fourteen or fifteen, and lasts till about forty-five, when it disappears; to this latter period is often applied the terms, *critical period*, *change of life*, &c. During the whole of a woman's menstrual life she is capable of conceiving; after this, her reproductive function ceases. The approach of puberty is announced by other changes than those mentioned. The mammæ are developed, the form becomes rounded, the pelvis expands, and the pudendum is covered with a growth of hair. The influence of climate in promoting or retarding the approach of puberty, has been shown by recent observation, to be over-rated, the average period being about the same all over the world.

Mr. Roberton has attempted, and successfully, to show, that the age of puberty is about as early in the cold, as in the tropical regions of the earth; and, that were marriages to take place in England at as juvenile an age as they do in Hindusthan, instances of very early fecundity would be as common in England as they are in that country. He is of opinion, that early marriage and early intercourse between the sexes, where found prevailing generally, "are to be attributed, not to any peculiar precocity, but to a moral and political degradation, exhibited in ill laws and customs, the enslavement more or less of the women, ignorance of letters, and impure or debasing systems of religion." He has also shown, from statistical evidence, that menstruation does not occur more early in the negress than in the white female. Dr. Vaigas, of Caraccas, indeed, in a letter to Professor Meigs, of Philadelphia, affirms, that precocious menstruation is more common in the white than in the coloured.*

The flow generally returns every twenty-eight days, and lasts from four to six, and the amount discharged varies from four to eight ounces, though about this, there is no certainty, as every woman is a law to herself; what would be a profuse discharge in some, is rely normal in others. The first menstrual flow is generally pre- ed by languor, lassitude, pain in the back, headache, chilliness,

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nglison's Human Phys., Seventh Edition.

ıich generally disappear when the discharge takes place. The
ccurrences are often unaccompanied by any premonitory or
ınt symptoms. The theories that have been brought forward
ain the efficient cause of menstruation are too numerous, and
satisfactory to detain us here. The most popular is that
looks upon the maturation and escape of ova as the efficient
It is said that every twenty-eight days a Graafian vesicle
the surface of the ovary, and during its development and
ment puts the tunica albuginea and peritoneal coat upon the
and thus becomes a source of irritation; in consequence of
there is an afflux of blood to the parts (that is, to the ovaries,
and uterus), which is discharged into the latter organ; the
finally ruptures, the irritation is removed, and the flow
This view is supported by Drs. Lee, Gendrin, Negrier,
ɪt, Raciborski, and others; but is denied by Dr. Ritchie and
who contend that ova may be discharged without menstru-
ınd the reverse, that the maturation of ova is an *effect*, and
*ause.* That the ovaries *are* concerned seems proved by the
ıat in their absence there is no menstrual flow. The blood
discharged in menstruation is considered by Mad. Boivin to
ıtical with venous blood, and the opinion is adopted by Prof.
and M. Dugés. Although there are many, and the larger
r, who look upon it as altered blood, and deficient in fibrine,
t opinion would seem to be supported by the microscopic inves-
ıs of M. Donné and others. So far, therefore, as examinations
y show, that there is much resemblance between the catamenial
ge and blood. M. Donné, indeed, affirms, that it appears to
differ in no respect from blood; and, that if it occasionally
acid reaction, in place of being alkaline like ordinary blood,
simply owing to its being mixed with a great quantity o
mucus, which is always extremely acid, while he affirms tha
rine mucus is always alkaline.
uterus is congested during menstruation, so are the Fallopia
ոd ovaries; the vagina is relaxed and distensible, and the o
soft, pulpy, and swollen. All of which conditions disappea
he flow ceases, and the parts return to the normal condition.

## DISEASES OF WOMEN.

### MENSTRUAL DISEASES.

*norrhœa.*—By this term is understood an absence of th
ual flow. There are two varieties: *emansio mensium,* whe
ıve never appeared; and *suppressio mensium,* when, havin
ıpeared, they have been arrested from any cause. The fir
pend upon several causes, viz.: congenital malformation, a
of the ovaries, uterus, or vagina, closure of the cervix, im

perforate hymen, &c.; or, it may be dependent upon the health or habits of the patient. The diagnosis is not always easy; if malformation be suspected, recourse must be had to a per vaginam examination, and the defect, if possible, relieved by an operation. If the retention be dependent on constitutional causes, remove them. If the patient is of a full habit, venesection, mild diet, hip-baths, &c. When the reverse obtains, an opposite plan of treatment must be followed: tonics, as iron and its preparations, a generous diet, exercise, warm clothing, hip and foot baths; always bearing in mind that the woman is not *sick* because she does not menstruate, but that she does not menstruate because she *is* sick, or in other words that amenorrhœa may be merely a symptom of deranged health.

*Suppressio mensium*, occurs also in two forms: *acute*, when the discharge is arrested during the flow; as, by cold, emotions, &c.; and *chronic*, where it occurs in consequence of the acute, or from gradual failing of the health, disease of ovaries, and critical period, &c. The most important point in the early treatment is not to confound the disease with pregnancy. In the *acute form*, if there is much constitutional disturbance, venesection, or cups to the loins, laxatives, baths, and opium to relieve pains. In the *chronic form*, if possible, remove the cause: *tonics*, *aloetics*, and the means above mentioned; there being but a few direct emmenagogues.

*Dysmenorrhœa.—Painful or difficult menstruation.*—This may be dependent on a faulty condition of the system, upon neuralgia of the uterus, or an inflammatory state of that organ, or it may depend on mechanical constriction of the cervix. The discharge is often scanty, accompanied with great pain in the back, loins, fever, &c., and often with the elimination of membranous or shreddy coagula. The *treatment* during the paroxysm is antiphlogistic, as cups to the loins, revellents, baths, anodyne enemata. In the interval, tonics, if debilitated; alteratives, if inflammatory; and dilatation by the bougie, as recommended by Dr. Mackintosh, if there be stricture of the cervix. Females afflicted with this disease rarely conceive.

*Menorrhagia*, is an increase of the menstrual flow either in frequency or in quantity, and it may be either active or passive, the former occurring in robust plethoric habits, the latter in the reverse. The most common causes are nervous and vascular excitements, fevers, internal congestions, displacements of the uterus, and approach of the critical period, &c. It may be confounded with the hemorrhage arising from abortion, foreign growths, &c., within the uterus. The *treatment* varies; in persons of a full habit venesection may be necessary, rest, revulsives, saline laxatives, astringents, &c. In the interval, moderate diet, cold baths, &c. In debilitated cases, rest, tonics and astringents, and opium, good diet, &c. When the
hage occurs about the critical period, it often resists the ordi-
ry. Under such circumstances, the *ergot of rye* often

s a good purpose. It may be given in doses of from 5 to 10 rice or thrice a day. All stimulating and hot drinks should ded, and the patient kept in a horizontal position on a hard s. As soon as the discharge is entirely arrested, a blister be applied to the sacrum, and kept open, and vaginal ns of cold water, or of a solution of acetate of lead, r astringents, used two or three times a day. In taking the ns, the patient should assume the horizontal position, and our to retain the fluid for a short time. If displacements ectify them, avoid sexual excitement of all kinds, and employ lothing, frictions, &c.

*rious menstruation.*—Seems a provision to obviate the ill of suppressed menstruation, by substituting a similar discharge ome other part. It occurs from various parts of the body, nes from the gums, nostrils, eyes, lungs, anus, stomach, or om an amputated stump. The fluid sometimes resembles or- blood, at others, it has the characters of the catamenial fluid. occur at any time, and in any constitution. It is not, how- sually attended by any serious consequences.

*tment.*—After once occurring, the patient should be watched, e system relieved by some other means; venesection, astrin- sedatives, mineral acids; and, if debilitated, tonics may be

*orrhœa.*—An excessive and altered secretion of the mucus ed by the membrane lining the vagina and uterus, by the s of the interior of the cervix uteri, and by the lacunæ of the lum; generally white, or nearly colourless and transparent, nes yellow, or green, or slightly sanguineous, and of varying of consistency. The amount of constitutional derangement ing on the severity of the affection, and the susceptibility of ient (*Ashwell*).

seat of the discharge may be diagnosticated by examining it ers. If it be of a jelly-like consistence, resembling partl ted albumen, and taking place at intervals, and in smal ies at a time, it probably comes from the muciparous folli the neck of the uterus.

n the contrary, it be of a whey-like or creamy consistence rying in colour from white to green, or brown, it probabl from the mucous membrane of the vagina. In such case cous membrane is commonly found studded over with re the inflamed orifices of mucous follicles.

e is sometimes an offensive sanious ichor discharged, whos s probably in the cavity of the uterus, or the Fallopian tube lves.

e vaginal leucorrhœa is accompanied by a sense of weigh d soreness in the vagina, tenesmus, irritation of the bladde pain in the lower belly and thighs, &c. The discharge, at first thin and acid, becomes whitish, or yellowish, and more consistent. The occurrence of the discharge generally relieves the urgent symptoms.

*Treatment.*—If the patient be plethoric, bleeding should be practised, either general or local. Fomentations, rest, spare diet, and vaginal injections should also be used.

*Chronic vaginal leucorrhœa* is one of the most frequent diseases during menstrual life; sometimes, however, it precedes the menses. By most writers it is considered as a local disorder, inflammatory in its nature. It is frequently caused by cold, excessive coition, parturition, pessaries, displacements, and irritating food. There is seldom any pain accompanying it. If the discharge be great, weakness and pain in the back and loins may ensue.

The *treatment* consists in the use of depletory measures if required; the removal of pessaries; tonics if the patient be weak; opium if pain be present; and the use of the balsams and astringent injections.

The *uterine leucorrhœa*, which is also often accompanied by constitutional symptoms, requires the use of depletory measures at times, with the use of astringent injections, and tonics if the health be feeble, particularly the preparations of iron. A solution of nitrate of silver, applied by means of a speculum to the interior of the cervix uteri, has succeeded when other means have failed. Should there be any suspicion of a syphilitic taint, the remedies proper in such cases should be used.

## HYSTERALGIA, OR IRRITABLE UTERUS.

May be defined, a permanent and painful sensibility of the uterus, especially of its neck; often accompanied by increased frequency of pulse, a dry hot skin, and generally, in protracted cases, with gastric and renal derangement. This disease commonly occurs in the middle period of life, though it is sometimes met with in early youth.

The *local symptoms* are pain in the small of the back and sacrum, extending down the thigh to the knee, and around the brim of the pelvis to the lowest part of the abdomen. There are also sometimes erratic pains in the thorax and loins. The character of the pain is that of soreness, slight pressure relieves it, but it is aggravated by rough handling. Sometimes it is spasmodic, like those of abortion. Dewees describes the pain as often pulsating.

The pain is aggravated by excitement of any kind, by exercise, and sometimes by standing. Straining, either in defecation or urination, constipation, flatulence, and diarrhœa, all aggravate it.

An per vaginam examination may prove the uterus to be either [illegible] engorged, but not altered in form, size, or density; ex-

y painful to the touch, in the body as well as in the neck; the
"as if a knife had been plunged into it."
*ses.*—Among the predisposing causes may be placed, educa-
shionable life, prolonged lactation, and temperament. Among
:iting causes, bodily exertion during menstruation, astringent
ons, abortions, prolapsus and sudden arrest of the menses from
ıse.
*gnosis.*—From neuralgic dysmenorrhœa, by the constancy of
in. From acute inflammation of the cervix, by the absence
, swelling, and throbbing; by the absence of discharges, and
slight change of the cervix compared with the amount of
ıg.
*iology.*—Gooch considers it a permanently painful condition
ıterus, neither accompanied by, nor tending to produce change
structure. Ashwell considers it a modified inflammation, or
t, closely allied to inflammation or congestion.
*ıtment.*—Two indications present themselves, viz.: 1. To mi-
local suffering; 2. To sustain and improve the general health.
st indication will be fulfilled by the use of anodynes, either
mouth, rectum, or applied directly to the uterus itself; by
olication of nitrate of silver, by dilating the cervix by bou-
ıd by anointing the cervix with anodyne unguents, especially
guent. aconiti. The second indication, by rest, exercise in a
ɔent posture, or, if it suits best, on foot or horseback, tonics,
ous food, cold bath, or the douche, and cheerful society. Sca-
ons to the neck of the uterus are highly recommended by Dr.
ll, especially if there be any congestion. The introduction
pessary is often followed by marked relief, especially if there
descent.

## DISPLACEMENTS OF THE UTERUS.

lacements of the uterus are of three kinds, viz., *Prolapsus*,
*ɜrsion*, and *Anteversion*.

### PROLAPSUS UTERI.

ifies a sinking of the uterus nearly or quite down to the
rnum; when it protrudes beyond the vulva it is called *pro-*
*ı uteri.* The position of the uterus has been already de-
. (Page 24.)
*ses.*—Heaviness of the uterus itself; hence it often occurs in
regnancy; congestion of the uterus; ovarian and other ab-
l tumours; tympanitis; distension of the colon; relaxation
ligaments, and too early "getting up" after labour; tight
dancing, running, or any severe muscular exercise; leucor-
nd other exhausting discharges, straining, coughing, &c.

*Symptoms.*—In some cases there is no suffering at all, or merely a sense of fulness. At others, there is pain in the back and groin, extending down the thighs to the knees or toes. The patient suffers great distress in standing or walking, and in voiding the urine and fæces. Strangury is sometimes present from the extension of the irritation to the bladder. Sometimes leucorrhœa is present, at others menorrhagia. The stomach and bowels sympathize; there is anorexia, loss of tone in both stomach and bowels, constipation or diarrhœa, and sometimes tympanitis. The patient often becomes morose and irritable. In *procidentia* the patient often suffers no other inconvenience than that arising from the external presence of the organ, or its acrid discharges.

*Diagnosis.*—In addition to the above symptoms, a per vaginam examination reveals the nature of the disease. The presence of the os uteri, at the lower part of the tumour felt in the vagina, is almost infallible. From prolapsus of the bladder, rectum, or vagina, it may be distinguished by their greater softness and elasticity, and by the absence of the os uteri. *Procidentia* may be distinguished from partial inversion, by the presence of the os uteri at the lower portion of the tumour; by the absence of severe floodings, and by the smooth surface of the tumour.

*Treatment.*—Opinions differ much on this point. Nearly all agree as to the necessity of mechanical support in most cases. The difficulty is, *as to the mode*. In slight cases, rest in a horizontal position, with cold or astringent injections, are often sufficient. In prolapsus after confinement it is particularly necessary. Bandages, when they relieve, act by supporting the abdominal muscles, and those of the back, hence they may be useful in women who have borne many children, and in whom these muscles are much relaxed. They can never be regarded as *uterine supporters*. In decided prolapsus, and almost invariably in procidentia, mechanical support by means of *pessaries* becomes necessary. These differ in shape according to the end to be obtained, and the peculiar views of the practitioner using them. The mode of introduction is as follows: The patient being placed on her side or back, the long diameter of the instrument is to be placed in accordance with the long diameter of the lower outlet; then gently introduced by steady pressure. When fairly introduced it must be partially turned so as to place it transversely across the pelvis and above the tubera ischii. The globe pessary is more easily introduced and requires no turning. In procidentia the uterus should be first returned, and then retained by

of the pessary. In addition to these means the patient should

ld injections, or hip-baths, astringent injections, rest, for a

least, tonics, if her health be enfeebled, laxatives, if the

constipated, and astringents if diarrhœa be present. It

proposed to cure the disease by cutting out part of the

, or to produce cicatrices by caustic, which, by their contrac-
hall support the uterus.

## RETROVERSION OF THE UTERUS.

this term is understood a tilting backwards either of the fundus
or of the entire uterus, so that, if the pelvis be of the full
he fundus will be depressed below the promontory of the
i. This displacement is called *retroflexion*, when the fundus
.s forced backwards; *retroversion*, when the entire organ takes
osition.

*ses.*—It most commonly occurs in women who have borne
n, or who are pregnant, and is caused by a sudden impulse
ards either by a distended bladder, by long standing, or by a
i expulsive effort.

ing the early months of pregnancy the uterus is peculiarly
to this displacement.

t of the instances of retroversion are attributable to a distended
r; for, as this organ fills, it rises, and pulls the lower portion
uterus upwards; at the same time the fundus is pushed back-
by the repletion of the bladder; the os uteri therefore presses
t the neck of the bladder and produces retention of the urine;
ndus presses against the rectum and prevents the passage of
which thus accumulate above the point of pressure, and not
rohibit the ascent of the fundus to its normal position, but
force it lower. The accident may also happen from falls,
, lifting weights, and, according to Churchill, in the early
f menstruation, when the uterus is increased in weight by the
of blood. The growth of tumours in the neighbourhood of
ndus is also a cause.

*symptoms* are violent bearing-down pains, sense of fulness
stension about the loins and hollow of the sacrum, dragging
nsion in the groins, and inability to pass fæces or urine. A
ginam examination reveals the os tincæ thrust up behind the
ysis pubis, and the vagina seems to be obstructed by a hard
which is the fundus turned down into the hollow of the
i.

*treatment* consists in emptying the bladder and rectum, and
ig up the fundus by two fingers in the rectum, assisting them,
ssary, by a finger of the other hand in the vagina, by which
uteri can be hooked down. Venesection is sometimes neces-
relax the system. Sometimes merely emptying the bladde
ectum are sufficient, the uterus recovering itself through th
larity of the round ligaments. Sometimes it is necessary t
e the ovum, and let the uterus condense itself. At others,
g the uterus is required. The after-treatment is, rest in

horizontal posture, and the avoidance of the distension of the bladder and rectum. Prof. Simpson's "*womb-sound*" has been successfully employed in restoring the organ to its normal position in cases of retroversion of the unimpregnated uterus.

### ANTEVERSION OF THE UTERUS.

*Anteversion* is that displacement in which the uterus occupies a transverse position in the pelvis, the fundus being directed toward the symphysis pubis. *Anteflexion* is a bending of the uterus at the neck, by which the fundus is caused to approach the pubes.

*Causes.*—Violent expulsive efforts either during or after emptying the bladder, accumulation of fæces in the rectum, blows, falls, obstinate diarrhœa, contraction of the round ligaments, and pregnancy in the early months.

*Symptoms.*—Weight in the pelvis, pain in the hypogastrium and in the perinæum, sense of dragging from the loins, all increased by standing or walking. By a per vaginam examination the pelvis will be found blocked up by a tolerably dense body; the fundus uteri will be felt anteriorly, the cervix posteriorly. A sound introduced into the bladder will impinge upon the displaced fundus, which will be distinguished from stone, however, by the absence of the clicking sound.

*Treatment.*—Many cases cure themselves by directing the patient to let the bladder fill, and to keep the rectum empty. The organ may be readily replaced, if it have not contracted adhesions, by hooking down the cervix with the forefinger of one hand, while the fundus is elevated by the other; the patient should afterwards be kept in bed on her back for some days.

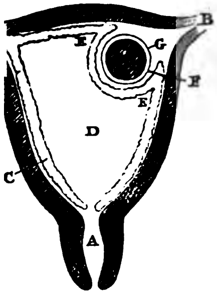
Various forms of pessaries have been recommended for the treatment of these diseases, but they are rarely necessary.

## GENERATION.

By this term is understood, *that function by which the species is reproduced*, and it is effected by the union of the two sexes. There are two principal theories of generation, viz.: that of *epigenesis*, in which each parent contributes a part to the developement of the new being, and that of *evolution*, in which the mother supplies all the necessary material, the male merely awakening the plastic powers resident in the female product. The popular belief is that each parent supplies material; the male, the seminal fluid; the female, the ovum; that a union of these two takes place, and from thence results the *tertium quid*, the new being. A great point of difficulty is, as to where this union takes place; some contending that it is in the ovaries, others, that it occurs in the uterus; the ovum having been previously discharged from the ovary, meeting the

ɔerm at that place. According to the recent observations of
ıste, the ovule undergoes disintegration within ten or twelve
after extrusion from the ovary. This would seem to con-
e doctrine of ovarian impregnation, or, at least, impregnation
p in the Fallopian tube. The only point that seems entirely
, is the necessity of *actual contact*, mere *aura* not being
nt to effect fecundation. The immediate result of this con-
r of successful intercourse, is the production of great ex-
ıt and vascular turgescence of the uterus, ovaries, and Fallo-
.bes, which lasts for some time. After fecundation has taken
both ovum and uterus undergo changes, the ovum developing
y its own plastic action upon the materials it derives from the
', at first by absorption through the villi of the chorion, and
ırds by the placenta, and the uterus increasing in size, and
ing upon its interior face a membrane called the *caducous*, or
*ɔus*, the formation of which has been variously explained.
According to Dr. W. Hunter, the whole interior of the uterus becomes coated with a pulpy fluid, which covers over the cervix and Fallopian tubes; this becomes hard, and resembles coagulated lymph, and is called the *decidua vera*. As the ovum now descends the Fallopian tubes on its way to the uterus, it comes in contact with this membrane at the orifice of the Fallopian tubes, and pushes it before it, at the same time that it is reflected over itself, thus forming the *decidua reflexa*. (Fig. 11.) It appears, however, from the late
hes of Dr. Sharpey and Professor Weber, that the decidua is
ɔomposed of the inner portion of the mucous membrane of the
itself, which undergoes a considerable change in its character.
id has described a tubular structure on the free surface of the
which becomes thickened and increased in vascularity within
time after conception; and when the inner surface of a newly-
nated uterus is examined with a low magnifying power, the
of its tubes are very distinctly seen, being lined with a white
ium. This is perhaps the more correct view, since the decidua
is found to be different in its structure from that of the decidua
'hich would not be, were they formed as described by Hunter.
an ovum has been thus fecundated, and brought to maturity
uterus, before extrusion, it is called *viviparous generation*.
the variety which occurs in the human female.

Fig. 11.*



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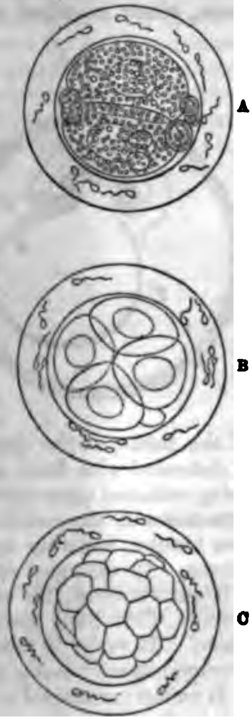
ɔk of womb; B, orifice of left Fallopian tube; C, decidua vera; D, cavity of the womb;
dua reflexa; G, ovum; F, chorion.

## DEVELOPMENT OF THE FŒTUS.

has already been stated that, after impregnation, the ovum de-
es itself by its own plastic power, out of the materials supplied
y the mother. It will be remembered that it was originally con-
l within the Graafian vesicle, and that it contains a yolk simi-
that seen in the hen's egg, although much smaller, in the
of which is found the germinal vesicle, on whose walls is the
inal spot or nucleus, from which all the various parts of the
being are developed. According to some physiologists, im-
ation takes place in the ovary, and before the rupture of the
ian vesicle; according to others, the
ian vesicle is ruptured first, the ovum
es into the Fallopian tubes and meets
ale sperm on its way to the uterus.
irst change which can be discovered
fecundation and consequent upon it,
e *cleavage* of the yolk, which re-
itself first into two, then into four,
into eight segments (Fig. 12, A, B, C),
segment containing a transparent
e, probably a descendant of the ori-
cell germ. By a continuance of this
s the whole cavity of the yolk mem-
becomes filled with a collection of
which, from its mulberry-like appear-
is called the germinal or mulberry
An envelope is now formed around
of the component segments of the
converting it into a vesicle, of
the contained particle is the nu-
This happens first to the peripheral
ns of the mass, which arrange
selves at the surface of the yolk into
mbrane, which, becoming thicker by
ddition of new cells from the interior,
what is called the "*germinal mem-
;*" and as this forms a complete sac
unding the liquid yolk, and as the
structure of the future embryo origi-
in its substance, it has been called
*mic vesicle.* On one portion of
a number of cells accumulate,

Fig. 12.*



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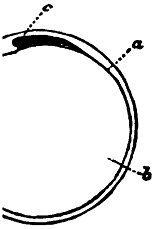
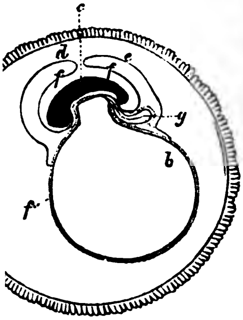
segmentation of the vitellus of the *Mammalian Ovum*:—A, its
; B, subdivision of each half into two; C, further subdivision,
&c.

Fig. 13.*



constituting what is called the *area germinativa* (Fig. 13 *c*), in which all the structures of the permanent organism originate, whilst the germinal membrane itself subdivides into two layers, an inner *mucous* and an outer *serous*, between which is subsequently developed the *vascular* layer. The external layer becomes the integument; the middle, the vascular system; and the internal, the digestive apparatus.

Fig. 14.†



: *Amnion.*—The outer or serous layer of the germinal mem- at the point where the embryo is developing itself, rises up on ide of it in two folds, forming the inner membrane of the which is called the amnion. These two folds gradually approach each other till actual contact takes place, in the space between the general envelope and the embryo, so as to form an additional investment to the latter. As each fold contains two layers of membrane, a double envelope is thus formed, of which the outer layer (Fig. 14, *d*, *e*) afterwards adheres to the inner surface of the chorion; whilst the inner one (Fig. 14, *f*, *f*) remains as a distinct sac, to which the name *amnion* is given.

"The membrane thus formed embraces the embryo very closely at an early period, and is continuous with the common integument fœtus, at the open abdominal parietes. At a later period it ended with fluid, and so separated from the fœtus, and after reflected upon the funis, of which it forms the outer coat, it ıates at the umbilicus. . It is thin and transparent, but of a ɜxture, resisting laceration much more than the other mem- :. Its extended surface is somewhat flocculent, but internally uite smooth, like serous membrane, and like it secretes a bland This fluid resembles dilute serum, and is called *liquor* . It varies in amount from half a pint to several quarts, the ;e quantity being about half a pound.

ubserves several useful ends. It probably serves as a nutri-

ı of early *Uterine Ovum.* Within the external ring, or zona pellucida, are the blas- c vesicle, *a*; the yolk, *b*; and the incipient embryo *c*.

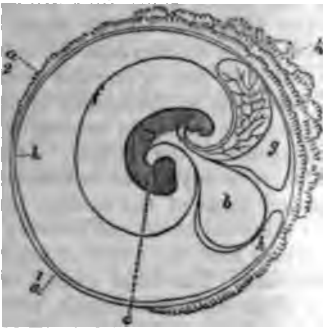
ıorion; *b*, umbilical vesicle, surrounded by the serous and vascular laminæ; *c*, am- *e*, and *f*, external and internal folds of the serous layer, forming the amnion; *g*, al- llantois.

ment to the fœtus during the early months; it preserves an equable temperature for it while remaining in utero, it protects it from the effects of sudden blows, shocks, &c. It is also useful in dilating the os uteri, by protruding the membranes in the commencement of labour.

The *Umbilical Vesicle* is formed by the doubling in of the mucous layer under the abdomen of the fœtus, so as to enclose a cavity containing the yolk, which communicates with the digestive tract. (Figs. 13, 14, *b*.) Upon the yolk the embryo subsists as long as it lasts, the umbilical vesicle becoming smaller and smaller as it is absorbed, until finally only a narrow orifice remains, which ultimately closes up and the umbilical vesicle is thrown off; it may, however, be detected upon the umbilical cord up to a late period of pregnancy.

*The Allantois.*—After the yolk has been entirely absorbed, it becomes necessary that the fœtus should have some other means of support, and the following are supplied. From the inferior or caudal extremity of the fœtus there arises, at the point where the urinary bladder is afterwards seated, a delicate membranous sac, which is formed from the mucous layer, and has distributed upon its surface, a number of minute blood-vessels, from the vascular layer; this

Fig. 15.*



vesicle gradually extends itself between the amnion and the chorion, until it comes in contact with that portion of the uterine surface, where the villi of the chorion are most abundant; here the vessels which it carries attach themselves, in order to form the placenta, and the allantois having fulfilled its function shrivels up, although traces of it may be found in the cord. In its development the

[illegible] a Human Ovum in second month; *a*, 1, smooth portion of the chorion; *k*, *k*, elongated villi, beginning to collect into placenta; [illegible] embryo; *f*, amnion (inner layer); *g*, allantois; *h*, outer portion.

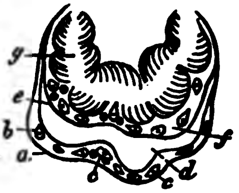
s passes out of the anterior part of the abdominal cavity, in ion of the umbilicus, which at this time is open. As the is closing, by the gradual development of its walls towards dian line, it is separated into two portions, which communi- hat part which is within the body, forms the urinary bladder, s urachus or tube of communication. (Fig. 15.)

*Chorion*.—The outer membrane of the ovum is called the , and is formed during its passage through the Fallopian y receiving an additional layer of albuminous matter secreted he walls of the tube, and this is surrounded by a fibrous ane. This new formation is one of great importance, as it is h this the whole subsequent nutrition of the embryo is de- this is accomplished at first by means of a number of villous es, which proceed from the whole surface of the chorion, and a rough, shaggy appearance; these villous processes serve rbing radicles, drawing in the fluids supplied by the mother, more perfect communication is afforded by the placenta. As m advances in age, these villi diminish in number, assume a ar appearance, and finally disappear altogether, except at that the chorion which is in contact with the uterus, and where centa is subsequently formed. In some animals, this con- between the villous coat of the chorion and the uterine sur- the only one that exists, hence they are called *non-placental*.

*Placenta*.—The formation of this organ commences by the tion of the villi of the chorion into the tubuli of the decidua, described; later we find a vascular connexion established n them and the villi, by the agency of the allantois, in the r abovementioned, the allantois conveying the blood-vessels fœtus to that portion of the chorion. It must not, however, erstood, that there is any direct communication between the of the fœtus and those of the mother, the fœtal tufts being *bathed* in the maternal blood and drawing nourishment from s own cells, which have the power of selecting, and of elabo- their own materials. The fœtal portion of the placenta con- the branches of the umbilical vessels, which divide minutely they enter the organ, and constitute by their ramifications a ortion of its substance, each subdivision terminating in a villus. illus contains a capillary vessel, which forms a series of loops, nicating with an artery on one side and with a vein on the

The vessels of the villi are covered by a layer of cells en- n basement membrane (Fig. 16). The maternal portion may be red as a large sac, consisting of a prolongation of the internal the great uterine vessels. Against the fœtal surface of this placental tufts push themselves, dipping down into it and g before them a portion of its thin wall, so as to constitute a to each tuft. The blood is conveyed into the cavity of the placenta by the "*curling arteries*," so named from their tortuous course, which proceed from the arteries of the uterus; and the blood is returned through large uterine veins, called *sinuses*. The placenta performs the twofold office of an absorbing and respiratory organ; it begins to be formed about the end of the second month, acquires its peculiar character during the third, and goes on increasing in proportion to the development of the ovum. At full term its diameter is about six or eight inches, its circumference eighteen to twenty-four, and its thickness from one inch to an inch and a half. Its internal or fœtal surface is smooth and shining, being covered by the chorion and amnion; the outer, or uterine surface, is level but not so smooth, being divided by numerous sulci between the lobules of which it is composed.

Fig. 16.*



*The umbilical cord*, called also the *funis*, or *navel-string*, is the means of communication between the fœtus and placenta. It usually arises from the centre of the placenta, though sometimes from the edge, forming the *battledore placenta*. It consists of two umbilical arteries, and one umbilical vein; besides these it contains the duct of the umbilical vesicle, the omphalo-mesenteric vessels, the urachus, and sometimes more or less of the intestinal canal, the whole imbedded in the Whartonian jelly, and invested by a reflection from the amnion. The length varies much; the average, however, is about eighteen inches. Sometimes it is so short as seriously to impede the progress of the labour.

To return now to the development of the embryo, the account of which is condensed from the Elements of Physiology, by Dr. Carpenter.

The parts first formed are those which most clearly distinguish the vertebrated animals from all others, viz., the vertebral column and spinal cord. These first make their appearance in the situation of the cluster of cells known as the *area germinativa*, and are included under the name of *chorda dorsalis*, which is found to be composed, wherever it exists, of nucleated cells. From cells exterior to this, is developed the vertebral column. Concurrently with this development, appears the vascular system, which is first seen in the middle layer of the germinal membrane, called the *vascular*. Vessels are formed here which serve to take up the nutriment supplied by the yolk, and carry it to the tissues of the

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* Extremity of a placental villus:—*a*, external membrane of the villus, continuous with [illegible] membrane of the vascular system of the mother; *b*, external cells of the villus, [illegible] placental decidua; *c*, *c*, germinal centres of the external cells; *d*, the space [illegible] and fœtal portions of the villus; *e*, the internal membrane of the vil- [illegible] of the chorion; *f*, the internal cells of the vil- [illegible] of umbilical vessels.

o. These vessels are first seen in that part of the vascular
, of the germinal membrane which immediately surrounds
bryo, and they form a delicate network of vessels called the
r *area;* this gradually extends itself till the vessels spread
e whole of the germinal membrane, and it is through their
that the nutritious matter of the yolk is conveyed to the
. The vessels of the yolk-bag terminate in two large trunks,
omphalo-mesenteric, meseraic, or vitelline vessels, which enter
bryo at the point which afterwards is known as the umbilicus.
rst movement of fluid takes place *towards* the embryo, and
discovered before any heart is seen. The heart is formed in
bstance of the vascular layer, by a dilatation of the trunk, into
the blood-vessels unite. It is at first a mere excavation, but
ards its walls become more developed, and it is divided into cavi-
Along with the development of the vascular apparatus, appears
e permanent digestive cavity; this originates in the separation
all portion of the yolk-bag lying immediately beneath the em-
y a doubling in of the mucous layer, so as to enclose a cavity.
y subsequent prolongation and involution of its walls, is ren-
more complex, so as to form a stomach and intestinal tube.
gestive cavity communicates for some time with the yolk-bag
which it has thus been pinched off) by the opening that is left
imperfect meeting of the folds of the germinal membrane
rms its walls. In the mammalia, this orifice is gradually nar-
and at last completely closed; and the yolk-bag thus sepa-
s afterwards thrown off; it is then known as the *umbilical*
and may be seen upon the umbilical cord up to a late period
gnancy.

irst the body of the embryo is more elongated than afterwards,
e trunk is the first part developed, at the upper extremity of
is a small prominence less thick than the rest, and separated
indentation, which distinguishes the head. No traces of ex-
es can yet be discovered, or of any other prominent parts.
raight, or nearly so, the posterior part being slightly convex,
terior concave.

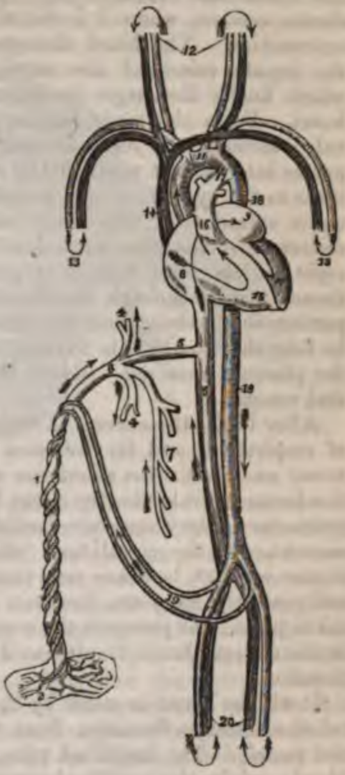
rwards the head becomes more rapidly developed, so that at
ginning of the second month, it nearly equals the half of the
body. In the fifth week, the extremities become visible, the
generally appearing first, in the form of small blunt promi-
. As they develope themselves, the distant points appear first,
, first the hands, which seem to be fixed to the shoulders, then
e-arm, then the arm. The same is true of the lower extremi-
The external organs of generation appear after the develop-
f the extremities, as also do the nose, ears, and mouth. Ossi-
commences in the base of the cranium, and the bones under
lp are those in which the process is last completed. The

length of a full-grown fœtus is about eighteen inches, the weight between six and eight pounds as the average.

*Fœtal circulation.*—The peculiarities of the fœtal circulation, in which it differs from that function in the adult are, 1st. The *ductus venosus*, a supplementary vein, situated at the thick edge of the liver, and leading from the umbilical vein to the vena cava ascendens. 2d. The aperture between the right and left auricle, effecting a communication between them, called the *foramen ovale*. 3d. The *ductus arteriosus*, a branch given off from the pulmonary artery soon after its origin, which conducts the venous blood that has arrived at the heart from the head into the aorta just below its arch.

The following is the route of the circulation in the fœtus, starting from the placenta. The blood, after being aerated in this organ, is collected by the *umbilical vein*, which carries it to the umbilicus of the child. After entering the cavity of the abdomen, the current divides,

Fig. 17.*



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* The fœtal circulation: 1, the umbilical cord, consisting of the umbilical vein and two umbilical arteries; proceeding from the placenta (2); 3, the umbilical vein dividing into three branches; two (4, 4) to be distributed to the liver; and one (5) the ductus venosus, which enters the inferior vena cava (6); 7, the portal vein, returning the blood from the intestines, and uniting with the right hepatic branch; 8, the right auricle; the course of the blood is denoted by the arrow, proceeding from 8 to 9, the left auricle; 10, the left ventricle, the blood following the arrow to the arch of the aorta (11), to be distributed through the branches given off by the arch to the head and upper extremities. The arrows, 12 and 13, represent the return of the blood from the head and upper extremities through the jugular and subclavian veins, to the superior vena cava (14), to the right auricle (8), and in the course of the arrow through the right ventricle (15), to the pulmonary artery (16); 17, the ductus arteriosus, which appears to be a proper continuation of the pulmonary artery—the offsets at each side are the right and left pulmonary artery cut off; these are of extremely small size as compared with the ductus arteriosus. The ductus arteriosus joins the descending aorta (18, 18), which divides into the common iliacs, and these into the internal iliacs, which become the umbilical arteries (19), and return the blood along the umbilical cord to the placenta; while the other divisions, the external iliacs (20), are continued into the lower extremities. The arrows at the termination of these vessels mark the return of the venous blood by the veins to the inferior cava.

f it being sent through the venæ portarum to the liver;
emainder reaches the vena cava ascendens through the
*venosus*, where it is mixed with the blood from the inferior
ities. The blood that was sent to the liver is collected by
patic veins and also emptied into the *vena cava* ascendens,
finally discharges its contents into the right auricle of the
From the *right* auricle, it is directed by the Eustachian
through the *foramen ovale*, into the *left* auricle, thence it
into the left ventricle, by which it is distributed through the
o the system, a large proportion of it going to the head and
extremities. The latter blood (that from the head, &c.), is
ed by the vena cava descendens, and emptied also into the
auricle, from whence it passes into the *right ventricle*, from
mainly through the *ductus arteriosus* into the aorta, a small
n only passing into the pulmonary artery. From this it will
n that the liver is the only organ that receives the blood from
centa *unmixed*. Every other organ receiving mixed arterial
nous.

r birth, the current is entirely changed by the establishment
piration, and its diversion into the lungs. The ductus ve-
and the ductus arteriosus shrivel up into ligamentous cords;
amen ovale shortly closes by the apposition of its valve; the
nary artery and vein become dilated to receive the increased
t, and the circulation, which before resembled that of the
reptiles, becomes now that of the perfect mammal. It not
uently happens, however, that some arrest of development
place, and prevents the completion of these changes; various
mations hence result, involving an imperfect discharge of the
n.

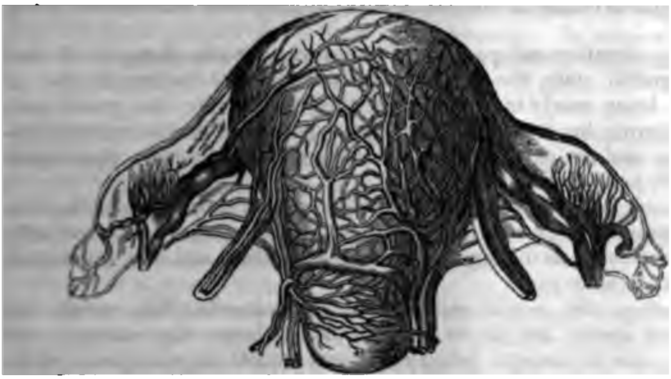
ill be borne in mind by the student, that there is, in the fœ-
ulation, a deviation from the normal function in several of
sels. The umbilical vein and ductus venosus carry *arterial*
while the umbilical arteries and ductus arteriosus carry
blood (Fig. 17).

## PREGNANCY, ITS PHENOMENA AND DISEASES.

re entering upon the consideration of the signs by which a
knows herself to be pregnant, it will be proper to examine
urther changes take place in the uterus itself. It has already
ated that the uterus becomes more vascular, after conception
en place, and that its interior lining becomes altered; the
, arteries, veins, and lymphatics are increased in size, and it
n said by Dr. Robert Lee, that the nerves are also increased
bers, although this latter change is doubted by many. The
tissue of the uterus also undergoes great changes. In propor-

tion; as the ovum is developed, the fibres are separated from each other, and increased in number, leaving spaces between them which

Fig. 18.



are filled by the enlarging vessels (Fig. 18). That the amount of substance is absolutely increased, is shown by the difference of weight between a virgin uterus, and one at full term, just emptied; the former weighing one ounce, the latter nearly twenty-four. The increase in the development of the womb is not uniform from the first, but commences at the fundus, gradually extending to the body, and last of all, about the fifth month, to the cervix. Up to the fourth month the uterus is generally retained entirely within the pelvis; shortly after this, its fundus may be felt above the symphysis pubis in thin persons; about the fifth month it reaches midway between the pubes and umbilicus, gradually ascending till the eighth month, when it is as high as the ensiform cartilage. After this, although it increases in capacity, it no longer ascends; on the contrary it rather falls. Its capacity is also greatly increased: according to Levret's calculations, its superficies may be estimated at 339 inches, and its cavity will contain 408 inches; its length being from 12 to 14 inches, its breadth from 9 to 10, and its depth from front to rear, 8 to 9 inches. The weight of the whole organ, and its contents, at full term, is about twelve pounds. The *form* of the gravid uterus differs also from that of the unimpregnated state, and this difference appears to depend in a great measure upon its increase in size, and the form of the cavities it occupies. In the non-gravid state, when it occupies the cavity of the pelvis, its anterior surface, corresponding to the bladder, is flat-

hile its posterior aspect is convex. The reverse, however,

he latter half of pregnancy. The anterior surface is *nvex*, being merely covered by the yielding anterior wall of lomen; whilst posteriorly the uterus is nearly concave, corre- ıg to the prominence of the lumbar vertebræ. This condition ıgs may be readily ascertained by examining the abdomen of ıant female in the last months of gestation, whilst she is lying

situation and position of the uterus are also changed: in the ıvid state, the fundus inclines somewhat backwards, the os eing nearly in the centre of the pelvic cavity; the gravid ute- ring the latter half of pregnancy, has its fundus inclined for- and the os uteri directed backwards towards the upper part hollow of the sacrum.

*ing the first month*, the changes are not very appreciable, the is larger, softer, and more vascular, the *os* and *cervix* are soft, shiony, as during the menstrual period, and the transverse is more *oval.*

*ing the second month*, abdomen somewhat flat, cervix in- l in size, and the os uteri can be felt lower than natural; its ılso is changed, being round and smooth in primiparæ, while tiparæ it is larger and irregular in shape. The canal of the is closed by a gelatinous plug.

*ing the third month*, slight protrusion of the abdomen, os ıot so easily reached, and somewhat changed in position; it onger in the middle of the pelvic cavity, but inclines towards llow of the sacrum, while the fundus approaches more nearly anterior parietes of the abdomen.

*ing the fourth month*, the fundus may be discovered two or nches above the symphysis pubis in thin persons by pressure, first relaxed the abdominal parietes, and emptied the bladder ctum.

*ing the fifth month*, the cervix is drawn out by the expanding and shortened, and the fundus may be felt halfway between mphysis pubis and umbilicus.

*ing the sixth month*, the cervix has lost very nearly one-half gth, the fundus is as high as the umbilicus, and the navel de- n begins to disappear.

*ing the seventh month*, the cervix is only half its original ; the fundus rises a little above the umbilicus, which often be- pouting. The head may also be felt per vaginam by ballotte- and the movements of the child detected through the abdomi- lls.

*ing the eighth month*, the cervix is not more than a quarter inch long, abdomen increased considerably in size, and the i so high as scarcely to be reached. The fundus is about y between the umbilicus and scrobiculus cordis.

*ing the ninth month*, the neck is obliterated, so that upon making an examination, we find the vagina closed superiorly by the rounded lower end of the uterus, and in primiparæ the fundus is at the scrobiculus cordis. During the last few weeks of pregnancy the fundus sinks a little, the abdomen falls, the os uteri appears only as a little dimple, and its edges are thin and membranous; it occupies now the upper part of the hollow of the sacrum. In women who have borne many children the cervix does not entirely disappear.

## SIGNS OF PREGNANCY.

These are divided into the *rational* and *sensible*, the latter of which only can be depended upon, as the former may occur in abnormal conditions of the uterus, independent of pregnancy. The rational signs occur in the earlier months; the sensible or physical, after the ovum is somewhat developed. The diagnosis is at all times difficult in the early periods.

*Rational signs.*—Plethoric condition and fibrinous blood; variations in temper and taste; altered functions of stomach, bowels and kidneys; change in the colour of the skin; *cessation of the menses*, though not invariable, is one of the earliest signs; *morning sickness*, from the sympathy between the uterus and stomach; *salivation*, not to be confounded with mercurial ptyalism, from which it may be distinguished by the absence of sponginess of the gums, and the peculiar fetor; *enlarged* and *painful mammæ*, and in many cases a *darkened areola* and enlargement of the follicles situated in it, with a soft and moist state of the integuments; *milk in the breast;* this fluid is sometimes found in the breasts during the latter stages of gestation, but is not invariable, nor always to be depended on when present. *Quickening;* this sensation has been variously described, some authors say it is caused by the first movements of the child; others assert that it is caused by the sudden rise of the uterus from the pelvis into the abdominal cavity, producing fainting, sickness, &c. As a sign of pregnancy it is almost valueless, since females are very apt to be deceived in this respect by the movements of flatus in the bowels, by occasional spasmodic twitching of the abdominal muscles, &c.

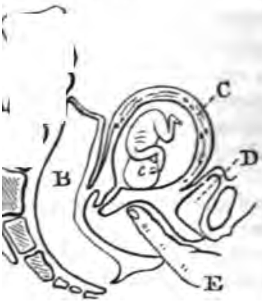
*Kiesteine.*—During pregnancy a peculiar substance, analogous to caseine, is found in the urine, forming a thin pellicle upon its surface when it is allowed to stand, which emits an odour resembling cheese. It is not, however, peculiar to pregnancy, but may occur whenever the lacteal elements are not eliminated by the mammary glands. At the same time the probabilities are as 20 to 1, that the ale is pregnant, if the kiesteine be present.

*ue colour of the vagina* has also been looked upon by M. Jac-
ier, and M. Parent Duchatelet, as among the rational signs of

S OR PHYSICAL SIGNS OF PREGNANCY, are those by the presence of a fœtus in utero are detected by an exploration organ itself.

*argement of the abdomen*, begins to be perceptible about the the second month; before this the abdomen is often flatter sual. "A ventre plat, enfant y'a."

Fig. 19.*



*Ballottement*, is practised thus: The patient should be in the *upright position*, or at least in a semi-recumbent posture: now let the operator place the left hand upon the fundus uteri to steady it, and introduce the index finger of the right hand to the cervix uteri, then suddenly but gently jerking the finger upwards, he will feel a sensation as if something had receded from it, and then settled down upon it again. This test is most available about the fifth and sixth months. (Fig. 19.)

*cultation* was applied to the detection of the presence of a in utero, first by M. Mayor, of Geneva. Three sounds have eard by different observers, viz.: that of the fœtal heart, that placental circulation, and that of the pulsation in the cord. st of these is the most certain; the second may be imitated pressure of a tumour upon any great vessel, and the last can e heard under very favourable circumstances, as where the ies between the child and the abdomen of the mother. The on in which the fœtal heart is most distinctly heard, is about iddle point between the scrobiculus cordis and symphysis generally to the left. The frequency of the pulsation is about that of the adult, ranging from 120 to 140 per minute, and y independent of the maternal circulation. The sound re- s very much the ticking of a watch under a pillow. In breech tations it is usually heard a little higher.

is a most valuable diagnostic sign, and if once heard, une ally, the real nature of the case is established beyond doubt.

*placental souffle* may usually be detected by the stethoscope the sides of the abdomen, after the fourth month; it is r blowing sound, corresponding to the pulse of the mother.

*movements of the child* may frequently be detected by placing hand on the abdomen of the mother, after the sixth month

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rtical section of sacrum; B, rectum; C, uterus and ovum; D, bladder; E, finger i a with its extremity pressing up the uterus.

is is not a certain sign, as above stated, since it may be imi- by movements of flatus, &c.

following *resumé* of the signs of pregnancy is taken from Elements of the Principles and Practice of Midwifery," by Tucker :—

### DURING THE FIRST AND SECOND MONTHS.

RATIONAL SIGNS.

appression of the catamenial rge.

ausea, vomiting, ptyalism, ia, &c.

anatural flatness over the hy- rium.

umefaction and tenderness of mmæ.

SENSIBLE SIGNS.

1. Increase in the size and weight of the uterus.
2. Slight prolapsus of the uterus.
3. Diminished mobility of the uterus.
4. The cervix uteri is directed towards the symphysis pubis.
5. The os uteri, round and regular in primiparæ, but in multiparæ, irregular in its circumference and more or less open.
6. Ramollissement of the mucous membrane, covering the cervix uteri. The fibres of the neck not yet softened.

### DURING THE THIRD AND FOURTH MONTHS.

ppression of the catamenia.

ntinuance of nausea, vomit- orexia, ptyalism.

ght prominence over hypo- m.

pression of the umbilicus.

umefaction of the breasts in- , with increase in the promi- f the nipple, and a slight dis- on of the areola.

steine in the urine.

1. The fundus uteri elevated rather above the pelvic brim, at the end of the third month. At the termination of the fourth month, it rises two inches above the pubis.
2. Fulness and dulness over the hypogastrium.
3. Existence of a small tumour in hypogastric region.
4. The direction of the long diameter of the uterus is now changed, so as to correspond with the axis of the pelvic brim. The os uteri is considerably elevated in the excavation.
5. Ramollissement of the inferior portion of the cervix is more marked: os uteri more open in the multiparæ, but still closed in those who have not borne children.

### DURING THE FIFTH AND SIXTH MONTHS.

ppression of the catamenia.

ssation of nausea, vomiting, r usually takes place, though y continue throughout preg-

1. At the end of the fifth month, the fundus uteri is within an inch of the umbilicus.
2. Movement of the fœtus is now active.

| RATIONAL SIGNS. | SENSIBLE SIGNS. |
|---|---|
| creased prominence of the al region.<br>e size of the abdominal tu- increased, it is round, elastic, he abdominal walls be thin, qualities of the fœtus may be<br>e umbilical region more full.<br>scoloration of the areolæ more l, with an enlargement of the neous glands.<br>esteine in the urine. | 3. The bruit de souffle and the fœtal pulsations may now be distinguished.<br>4. Ballottement.<br>5. Between the cervix and the pubis a tumour may now be felt, either soft and fluctuating, or round and hard.<br>6. Ramollissement of one half of the cervix uteri.<br>7. In the primiparæ, the os uteri is still closed, but in the multiparæ; it is sufficiently open to admit the half of the first phalangeal bone. |

### DURING THE SEVENTH AND EIGHTH MONTHS.

| | |
|---|---|
| ppression of the catamenia.<br>ausea, vomiting, &c., ordina- sent.<br>bdominal tumour much in- l in size.<br>outing of the navel.<br>creased discoloration of the , with enlargement of the ous follicles, and increased ence of the nipple.<br>he milk may now be pressed e swollen mammæ.<br>iesteine still exists in the | 1. Increase in the size of the abdomen.<br>**2. The fundus uteri, at the end of the seventh month, has risen two and a half inches above the umbilicus; at the eighth, it is placed within the epigastric region.**<br>3. Active movements of the fœtus.<br>4. The fœtal pulsations and the bruit de souffle still continue.<br>5. Ballottement perfectly felt during the seventh month, becomes obscure in the subsequent months of pregnancy, on account of the increase in the size of the fœtus.<br>6. The ramollissement of the cervix is more extensive, and at the end of the eighth month is nearly complete.<br>7. In the primiparæ, the cervix is ovoid and somewhat shortened; the os uteri is still closed.<br>8. In the multiparæ, the os uteri is wide enough open to admit the whole of the first phalangeal bone; the upper orifice is firmly closed. |

### DURING THE FIRST HALF OF THE NINTH MONTH.

| | |
|---|---|
| eappearance of vomiting, not ausea, but from pressure of avid uterus against the sto-<br>he abdominal tumour is in- l in size.<br>espiration difficult. | 1. The fundus uteri occupies th epigastric region.<br>2. The movements of the fœtus the pulsation of the fœtal heart ar still present. At this time, ballotte ment has disappeared.<br>3. The whole cervix uteri is soft |

| RATIONAL SIGNS. | SENSIBLE SIGNS. |
|---|---|
| 4. All the other symptoms are augmented in intensity. | ened, except the internal orifice, which remains firm and closed. The os uteri in primiparæ is slightly opened, though not sufficiently to admit the finger, as is the case in multiparæ. |

DURING THE LAST HALF OF THE NINTH MONTH.

| | |
|---|---|
| 1. The vomiting ceases, as the abdominal tumour sinks from the epigastrium.<br>2. Respiration less oppressed.<br>3. Considerable difficulty exists in walking, owing to the sinking of the presenting part into the pelvic excavation.<br>4. Constant desire to evacuate the bladder and rectum.<br>5. The hemorrhoids, the œdema of the limbs, and the varicose condition of the veins of the inferior extremities, are all increased. | 1. The fundus uteri has sunk lower down in the abdomen.<br>2. The sensible signs still persist, except ballottement, which is usually, though not always, absent after the fœtus has acquired considerable size.<br>3. In multiparæ, the internal orifice of the cervix is softened and dilated so that the membranes may be felt. In the primiparæ, the internal orifice is soft and dilated, but the external remains partially closed. During the last ten or twelve days, owing to the dilatation of the internal orifice of the cervix uteri, the whole cervix becomes enlarged, so as to increase the size of the uterine cavity; so that *in touching*, the finger reaches the membranes, in the primiparæ, after having passed the thin and even margin of the os uteri, while in the multiparæ, the external orifice of the cervix is thick and unequal. |

*Duration of Pregnancy.*—On this subject very little can be positively said, the *average* duration being about ten lunar months, or 280 days. There can be no doubt that many females fall short of this computation, as well as that there are many who go beyond it. Many well-authenticated instances are on record, under the authority of Drs. Merriman, Blundell, Montgomery, Dewees, Meigs, and others, where both these deviations have occurred. The same is true of the lower animals. Dr. Rigby supposes that the duration of pregnancy is much influenced by the time in the intermenstrual period at which conception took place; that there is at every menstrual period an irritability about the uterus, even when gravid, which disposes it to take on contraction. Hence, when impregnation has occurred immediately after an appearance of the menses, the uterus will have attained such a dilatation and weight of contents by the time that the ninth period has arrived, that it will not be able to pass through this state of catamenial excitement without contracting, or in other words, labour coming on: hence it is that we find a considerable r of labours fall short of the usual time, so much so, that uthors have even considered the natural term of human gesto be 273 days, or 39 weeks.

n the other hand, impregnation has occurred just before a ual period, the uterus may not have attained such a develops to prevent its passing the ninth period without expelling tents, but may even go on to the next without this process place. Under this view of the subject, he further remarks, luration of time between each menstrual period should also en into account, some women menstruating at very short, at very long intervals; but although this will affect the r of periods during which the pregnancy will last, it will not ce the actual duration of time, as this will more immediately upon the size and weight of contents which the uterus has d."

method of calculation is, to compute from a fortnight after t appearance of the menses, and the period so fixed is usually ed by the time at which quickening occurs, the latter occurısually taking place at four months and a half.

*·a-uterine Pregnancy.*—It occasionally happens that the ovum, of passing down the Fallopian tube to the uterus, is arrested ›rogress, and an effort is made at the point of obstruction to ›pace and nutrition for the fœtus. When the ovum is deand developed in the ovary, it is called *ovarian pregnancy.* s variety Dr. Granville relates a case in the London Phil. ctions, Part 1, 1820. When the Fallopian tube is the seat arrest, it is called *tubal pregnancy;* of this variety cases are d by Dr. R. Lee, in the Lond. Med. Gaz., vol. xxvi., p. 436. y Dr. Meigs, *vide* his work, p. 227. It sometimes happens e ovum enters the parietes of the uterus, constituting a third ·e description called *interstitial pregnancy.* A fourth variety ·d *ventral* or *abdominal pregnancy,* where the ovum falls e abdominal cavity, attaches itself, and is developed there. ›rthy of remark, that in all these varieties, the uterus is lined deciduous membrane, as it is in *intra-uterine pregnancy.* causes are not well known, and the treatment can be merely ve. Portions of the fœtus are often discharged from fistulous gs in the abdomen, vagina, or rectum.

## PREMATURE EXPULSION OF THE FŒTUS.

uterus sometimes expels its contents before the full period of estation is accomplished. This may occur at any time during n, though it appears to be more easily excited at, or pre-, the third month, owing to the frailty of the connexion behe ovum and the decidua. It is also more liable to occur at the commencement of each menstrual return, than in the interval, owing to the increased excitement of the gestative organs at that time. It is called *abortion* when the fœtus is expelled before it is capable of maintaining an independent existence, that is, before the *seventh month.* It does sometimes happen that a fœtus lives when expelled before this time, but such cases are rare. The child is hardly considered "*viable*" before this time.

*Premature labour* signifies the expulsion of the ovum before the full term of pregnancy has expired, but after the *seventh month;* in other words, after the child has become viable.

*Causes.*—These are infinitely various and numerous, and include almost every agency capable of acting injuriously on the mother, and through her on the fœtus. Mental emotions, fright, anger, joy, or sorrow when excessive, intense pain, shocks, blows, falls, great fatigue, deficient nourishment, debilitating evacuations, acute and chronic disease, the exanthemata, syphilis, and the habits of life, either extreme, being capable of producing it. To these we may add a peculiar constitutional irritability of some females, by which they abort *habitually.*

Premature expulsion is sometimes produced by circumstances which compromise the life of the child. Thus, certain pathological conditions of the amnion, chorion or decidua, malformations of the placenta, or erroneous insertion of the cord. Or it may occur from the administration of drugs exhibited for the purpose, or otherwise, such as ergot, savine, &c.

The manner in which these causes act, is either by destroying the child's life, in which method syncope, syphilis, and mercurial salivation seem to act; or by causing the womb to contract; or by partial separation of the placenta, causing the effusion of blood between that organ and the womb, and finally its entire separation, thus arresting the nutrition and respiration of the fœtus, and producing its death.

*Symptoms.*—The patient who is about to miscarry, generally experiences a sense of uneasiness, languor, pain in the back and lower part of the abdomen, accompanied by pains of an expulsive character, and often with hemorrhage. When the ovum itself is ruptured, there is a discharge of water from the vagina, greater or less, according to the age of the fœtus, followed afterwards by pain and discharge of blood.

Sometimes the ovum is discharged with little or no pain, at others the pains are described as being more severe than those of labour at the full term.

*Treatment.*—There are two points to be observed in the treatment of these accidents: *first,* If possible, to prevent the expulsion of the fœtus, and enable the woman to complete her pregnancy;

y, Where this is hopeless, to shorten the process as much as e, and prevent further hemorrhage.

ve cannot be certain in the first instance, whether the child is r not, it behooves us to act under the supposition of its life, g that if the vital relation between the ovum and the uterus promised it will be discharged.

*preventive treatment* will consist in moderate bloodletting, if ient be plethoric and the pulse full and bounding, rest in a horizontal posture, on a hard bed, lightly covered with , and in a cool room, cold wet napkins to the vulva, abstinence timulants, anodyne enemata, and if necessary, the internal astringents, such as infusion of rose leaves, elixir of vitriol, acetate of lead and opium, &c.

hese means fail, and the hemorrhage continues, whilst the is not expelled, there is little or no chance of preventing mis- e; our endeavours must be directed to the suppression of the rge, knowing it will generally cease as soon as the womb is d. The best agent we possess under these circumstances, is *npon*, or *plug*. This should never be used, however, if inter- morrhage can take place to such an extent as to destroy life; r words, not if the uterus be empty, and the patient far ad- in pregnancy. It may be used with safety and advantage, uterus be filled with its natural contents, or be only slightly ible, even though empty. For this purpose some recommend ge steeped in vinegar, others a silk handkerchief, others, small, square pieces of linen pressed into the vagina till that is entirely filled, the whole being retained in its place by a lage, or the hand of an assistant. It should be allowed to in situ, from six to twelve, or even twenty-four hours, the being still in a horizontal position, and the bladder, if ne- , relieved by the catheter. When withdrawn, the ovum, or nts of it, will generally be found adherent to its upper part, with a coagulum.

tampon, it will be remembered, is not to be used under any stance where there is a hope of saving the pregnancy.

he ovum is not discharged with the tampon, and cannot be d with either the finger or hook, it is recommended to leave ccurrences in the hands of nature, rather than use force.

*prophylactic treatment* consists in the avoidance of all causes itement, both mentally and bodily. Small bleedings and rest be plethoric; a nutritious diet and tonics if otherwise, toge- ith careful cold sponging. When the abortion is habitual, e uterus is irritable, an efficient remedy has been found in the istration of an opiate enemata every night, consisting of ive drops of tr. opii, in a wineglassful of starch water, rest, &c.

## PATHOLOGY OF THE FŒTUS, AND SIGNS OF ITS DEATH.

The fœtus is liable to many of those diseases that attack the child after its birth. Many of these are entirely independent of the mother, but there are also many with which it is affected seriously through her. As examples of the latter may be classed those cases of premature expulsion which occur during the prevalence of epidemic diseases, and where the fœtus appears to have participated in the disease of the mother. Dr. Churchill has observed a considerable quickening of the action of the fœtal heart, some days after pregnant women have been attacked with fever. Examples are not wanting of cases where children have been born with small pox or measles; and according to Duettel, Schweig, Zurmeyer, &c., children born of mothers who were suffering under *intermittent fever*, have exhibited the same disease immediately after birth.

There is scarcely an internal organ that has not been described as the seat of inflammation; the brain and its membranes, the lungs and pleura, the peritoneum, the mucous membranes of the lungs and bowels, may all be the seat of inflammation during uterine life.

In addition to these acute diseases, the fœtus presents even more numerous cases of chronic affections; general hypertrophy, or atrophy, syphilitic diseases, worms, calculus, dropsy, jaundice, hernia, &c. Even the bones and joints may be the seat of disease; children are sometimes born with rickets, caries, and necrosis; and it has happened to many practitioners to meet with cases of fractures of some standing in children just born.

Unfortunately we possess neither the means of diagnosticating, nor of treating these cases of intra-uterine disease.

*The signs of the death of the fœtus*, are also obscure and uncertain. Absence of the sound of the fœtal heart is a negative sign, and its value will depend much upon the skill of the auscultator. If after repeated and careful auscultation of the abdomen no trace of fœtal pulsation can be detected, the death of the fœtus may be asserted on safe grounds. *Cessation of the movements of the fœtus* is no proof of its death, as the movements may be suspended for some days without its occurrence. The sensation of a weight in the abdomen rolling about as she moves, is, with some rare exceptions, a sure sign. The subsidence of the abdominal tumour, flaccidity of the breasts, after having been tense, and the general deterioration of the health, are all enumerated among the probable signs. The concurrence of all these render the diagnosis nearly certain, though separately they are of little value.

*The signs during labour* are much more accessible and certain. The loose, flabby scalp, the absence of swelling, occasionally emphyf the cellular tissue beneath, the looseness and grating of the bones, and the sharpness of their edges, are enumerated by gby among the certain signs. The absence of pulsations at :at fontanelles, is admitted to be an important sign.

*resentations* of the *face*, the lips of a dead child will be flaccid : tongue flabby and motionless, and the presenting part slightly l. The contrary in a living child.

*reech presentations*, the sphincter ani in a dead child is relaxed sensible to the finger. In a living child it is closed and resists ger. The presence of meconium is a sign of no value.

*ırm presentations*, when the child is dead, the limb is cold, nd flabby, there is no pulsation at the wrist (the latter is not :h value, as pressure may arrest it), and the epidermis soon to peel off. In a living child, the arm will swell and become

*rolapsion of the funis*, the presence or absence of pulsation :cide. There are exceptions to this rule, however, as in the :lated by Dr. Kennedy, in which the cord was prolapsed an nd during a pain no pulsation was perceptible; when the pain :d he drew the funis backward towards the sacro-iliac sym- and then detected a faint pulsation. The child was delivered y the process.

*d liquor amnii* is not a certain sign of the child's death, is the presence of meconium in it, especially in breech cases.

## LABOUR.

his term is understood, *that process by which the contents of ıvid womb are expelled.* It should commence as we have seen, at or about the two hundred and eightieth day from t appearance of the menses, or about one hundred and forty uickening. The principal agent in affecting this process is rus itself, assisted, however, by the action of the diaphragm lominal muscles.

*cause* of labour is not well understood: it has been variously ted to the inability of the uterus to sustain farther distension, struggles of the fœtus in its endeavours to breathe, and to the of adequate nourishment. Whatever be the cause, certain at the fœtus contributes nothing to expediting the process, ntirely passive throughout, and the volition of the mother is tle concerned, farther than the assistance afforded by the ry contraction of the abdominal muscles and diaphragm, the f the uterus being entirely involuntary. This action consists contraction of the muscular fibres, which enter into the ition of the uterine parietes. By this contraction the cavity uterus is diminished in size, propulsion is produced, and eventually expulsion is effected. The action of the uterus continues even after the child is expelled, for the purpose of extruding the placenta, and closing the orifices of bleeding vessels, which might otherwise give rise to serious hemorrhage.

*The classification of labours.*—Almost every obstetrical writer has a classification in accordance with his own peculiar views, each based upon his definition of a *natural labour.* Some include under the head of natural labour, all those cases which are terminated by the natural unassisted powers, without reference to the presentation. Among these are Hippocrates, Smellie, Baudelocque, Rigby, &c. Others consider that the presentation should be taken into account, and those only which occur most frequently should be called natural. Denman, Blundell, Davis, Ashwell, Ramsbotham, &c., therefore limit natural labours to head presentations.

The simplest classification seems to be that which includes *all* under two heads, viz.: *natural* and *preternatural. Natural labour*, or *Eutocia*, being that which follows a natural course, and in which the woman is delivered unassisted; *preternatural labour*, or *Dystocia*, signifying faulty or irregular labour, the course of which is unfavourable, and in which the assistance of the obstetrician becomes necessary.

The *general features* of labour are the same in every case, but the details are widely different. It is always attended with suffering, if the patient be conscious; and is sometimes complicated with irregularities and danger. The *duration* also varies much, as well as the amount of pain, in different women, and in the same women in different pregnancies, some expelling their children with a single pain, others requiring many to accomplish the same object.

*The symptoms of labour* may be divided into the *premonitory*, and those which indicate that the process has *already commenced.* The premonitory are, the subsidence of the abdominal tumour; some slight mucous discharge from the vagina, together with relaxation and distensibility of it and the external parts; and a peculiar irritability and restlessness on the part of the patient.

The diminution of the abdominal tumour is produced partly by the subsidence of the uterus into the pelvic cavity, and partly perhaps by the painless contraction of the same organ. It is sometimes very sudden in its approach, the woman finding on rising from her bed that she is much less than on the preceding day. It is generally a good sign, as indicating that she has a roomy pelvis. The increased discharge and relaxation of the external organs is also a good sign, showing that there is a disposition in the passages to facilitate the progress of the labour.

The irritability and restlessness is seen also in the lower animals, and is therefore not peculiar to the human female.

The symptoms indicative of the *commencement* of labour are,

;lairy discharge from the vagina, irritability of the bladder ;tum, nausea and vomiting, and rigors or shivering, without ompaniment of chilliness.

*pain* felt in labour is due to the sensibility of the *resisting*, than to that of the *expelling* organs. The sharp, cutting of the commencement, which are technically called *grinders*, duced mainly by the stretching of the cervex uteri and the , and are generally referred to the lower part of the abdomen e back, in a position corresponding to the position of the os These generally accompany the dilatation of the os uteri, e indicated by the cries and gestures of the patient, the former of a moaning, complaining character, the latter, twisting and ıg.

en, however, the dilatation has gone to such an extent as to some of the contents of the uterus to be propelled through the g, the pains become of a *forcing, expulsive* nature, and the es attending them differ from those before mentioned. The is held; she no longer cries out, but makes strong expulsive as if straining at stool; she makes use of the muscles of ition to fix the thorax, and then contracts the abdominal mus- on the womb, at the same time pulling violently upon any- within her reach. The gestures and cries are valuable indica- f the character of the pains. The characteristic of the uterine s, that they are dull, and not very acute in their character; t mainly in the back and loins; that under their action the becomes *tight* and *hard;* and, particularly, that they are *r* and *intermittent;* that is, coming on at tolerably equal in- , and succeeded by an entire relief from suffering.

the commencement, the uterine pains are short, weak, and at ntervals; as labour advances, the interval becomes less, and ins longer and stronger. It is well known that labour pains e suspended, by any sudden emotion, particularly those of a sing character, as well as by opiates, administered either by uth, rectum, or rubbed upon the general surface.

*mucous discharge* which takes place from the vaginal surface, wn commonly by the name of *show.* It is generally mixed with latinous mucus that blocked up the uterine cervix, and with r less blood. "The more albuminous it is, the better, and it ys a good sign when lumps of albuminous matter come away time to time; the thicker, softer, and more cushiony the os s, the more mucus does it secrete." It is useful not only as icating agent, but also as a topical depletion, for by unloading ngested vessels, the vascularity and heat of the part are shed, and rendered more capable of dilatation.

*irritability of the bladder* and *rectum* are among the most ient signs of commencing labour, and are dependent upon the contiguity between the dilating os uteri and these organs, which all derive a portion of their nervous influence from the same source. The disposition to urinate exists even when the bladder is empty, and the tenesmic irritability of the rectum is equally independent of the presence of fæcal matter.

*Nausea* and *Vomiting*, at the commencement of labour, are looked upon as favourable signs, being indicative of a general relaxation, which favours the dilatation of the os uteri. It must not, however, be confounded with that which sometimes supervenes in lingering labours, which is rather prognostic of great exhaustion, and to be dreaded accordingly. In ordinary cases, vomiting in the early stages requires no treatment, being generally relieved as soon as dilatation takes place. When, however, it is very violent, it may often be checked by an effervescing draught, with a few drops of laudanum. The *rigors*, which often occur early in labour, are likewise accompaniments of the dilating os uteri, and although often severe, are not dependent on diminished temperature of the female, or irregular arterial action; they require little other treatment than an extra covering, and diluent drinks.

### STAGES OF LABOUR.

Some obstetricians divide a labour into three, others into four, five, or six stages, all ending with the expulsion of the placenta. The first division is the one generally adopted, and the three stages are thus enumerated. The first terminates with the dilatation of the os uteri; the second with the delivery of the child; and the third with the expulsion of the placenta.

*First stage.*—This is generally the longest and most distressing, both to practitioner and patient. The pain, although not so great as in the second stage, is of a more distressing character, and more difficult to bear. The patient is more irritable, uneasy, and alarmed as to the result. The character of the cry, as before mentioned, as well as the gestures, are peculiar to this stage, as well as diagnostic of it. Nausea and vomiting also occur during this stage, and, it is thought, assist in effecting it.

By placing the hand upon the abdomen during a pain, the uterus can be felt to contract and harden itself, and at the same time to tilt forwards so as to bring its axis into accordance with that of the superior strait. As the pain goes off, the uterus becomes soft again, without, however, returning to its former state of relaxation.

The approach of a pain may often be foretold by the practitioner before its access, by auscultation. "The moment a pain begins, and before the patient is herself aware of it, we hear a short rushing sound, which appears to proceed from the liquor amnii, and to be partly produced by the movement of the child, which seems to an-

the coming on of the contraction; nearly at the same mo-
ll the tones of the uterine pulsations become stronger; other
hich have not been heard before, and which are of a piping,
t character, now become audible, and seem to vibrate through
thoscope, like the sound of a string which has been struck
awn tighter, while in the act of vibrating."* As the pain
stronger, the pitch rises. By the time the pain has reached
ght, the sound has entirely ceased, or become very faint; as
rts, however, the sound again returns as at the beginning of
n, and finally resumes its former tone, which it had during
ncy. The noise made by the escape of the blood through
erine veins during a contraction, is probably an important
t in the production of the sound in question.

remarked also by the author quoted above, that the pulse
es in rapidity in proportion as the pain rises in intensity,
ing in the same manner with it. As the labour advances, the
y of the pulse increases, so that shortly before the child is
t has attained the maximum that it had during the height of
ins in the commencement.

er vaginam examination at the commencement of labour re-
o us the condition of the parts through which the child is
to pass. If the vagina is cool, moist, and cushiony, and the
ri soft and thick, the dilatation will most probably proceed
ably. If, on the contrary, the vagina is hot and dry, and the
i hard and thin, or hard and thick, the first stage will gene-
e tedious. *The time occupied in the first stage* varies very
in different women, and in the same women in different la-
In primiparæ, it is generally longer than in those who have
veral children. Regular and genuine contractions seldom
more than eight to ten hours to perfect this stage, and often
complished in much less. The dilatation also proceeds much
lowly at the commencement, than it does later; this is owing
want of the mechanical dilatation which it afterwards receives
formation of the bag of waters, which acts as a wedge, and
y distends the os uteri.

*of waters.*—As the circle of the os uteri enlarges, the mem-
of the ovum, containing a portion of the liquor amnii, pro-
through the opening, forming a tense, elastic, conical bag;
its mechanical pressure assists in the dilatation of the os
During a pain it can be felt becoming more and more tense,
in relaxing as the pain subsides, so that the presenting part
n be detected through it.

the end of the first stage streaks of blood will often be found
with the mucus upon the finger, after an examination. This

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[*] Rigby, p. 150.

is commonly denominated in the lying-in-rooms "*a show*," and it is usually an indication that the os uteri is dilated, or nearly so. The hemorrhage proceeds from the slight vascular twigs extending between the uterus and the membranes, which are ruptured by the increasing dilatation.

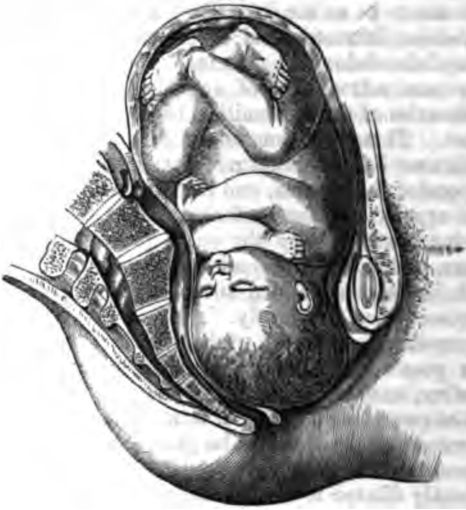
The phenomena which have been described are repeated during every succeeding pain (the intervals being shorter and the pains longer), until the dilatation of the os uteri is completed. During the whole period of the first stage, the pains have been acting, not so much for the expulsion of the child, as for preparing it and the passage for that purpose. The more completely the os uteri is opposite to the fundus, and the greater the correspondence between the axis of the uterus and that of the superior strait, the more speedily will the dilatation be accomplished. As soon as this has taken place, the first stage is ended.

*Second stage.*—The phenomena that present themselves in this stage differ essentially from those of the preceding. The pains succeed each other with greater frequency, and last longer, and the suffering is increased; but, in consequence of the respiratory muscles being fixed, in order to supply a fulcrum for muscular exertion, the woman rarely cries out during a pain. Hence the character of the cry, as before stated, is a diagnostic sign of this stage. The pains now appear not to be so much confined to the womb; they acquire a more *expulsive* character, and are attended with strong bearing-down efforts of the abdominal muscles. Upon the approach of each pain, the woman seizes hold of anything within her reach, and brings the muscles of the extremities, back, and abdomen to aid her in the effort. These are commonly called *bearing-down pains*. If the membranes have not ruptured previously, they generally give way during one of these pains, and the liquor amnii escapes through the external organs; the fœtus, forced downwards by the same contraction, immediately fills up the space previously occupied by the bag of waters, and the uterus condenses itself upon the body of the child, which is therefore folded into a smaller space, and is much more compressed than previously.

Each succeeding contraction pushes on the presenting part; but, as the pain goes off, it again recedes, not, however, to the point it occupied before, as there generally is more or less advance on that gained by the preceding effort. If it were not for this gradual advance and recession, there would be greater danger of laceration of the soft parts, from a continued expulsive effort before the passages sufficiently dilated to receive the presenting parts. It thus not takes away the danger of pressure, but is in itself a good sign, ch as it proves that the cavity of the pelvis is sufficiently ca- an during the second stage is much less irritable She seems to have recovered her energy and equa-

, and, if this stage be prolonged, will often sleep between the
The young practitioner should be on his guard, however, in
n to this drowsiness, particularly if it occur in primiparæ, and
ch protracted, or accompanied with headache, as it is indica-
congestion, and may be the precursor of convulsions.
ing the descent of the presenting part, particularly if it be the
we are often informed of its progress by the occurrence of an
sant symptom, viz., cramp in the lower extremities, produced
ssure upon the internal sacral nerves. Under the influence
ther pain the head descends along the vagina and begins to
ıpon the perineum, the rectum becomes flattened, and its con-
are involuntarily expelled; by the time it has reached the
f the pelvis it is about to meet with its greatest resistance,
ıat of the perineum. Here again we observe the gradual ad-
and recession, until this part is distended to such a degree as
w the presentation to escape over it. This distension is often
ıt, and the perineum so thin, that the finger can scarcely dis-
ıh it from the presenting part. Occasionally it happens that
his cause the part is rendered transparent, so that the presen-
is visible through it. Twice Madame Lachapelle has seen the
the fœtal head through the distended perineum (Fig. 20).

Fig. 20.



esenting part has now entered the inferior strait, the coccyx
ed backwards, and the external orifice is dilated; the anus

projects, and the whole perineum is elongated; the labia majora, and even the mons veneris, are put greatly upon the stretch, and the former disappear entirely; this is not the case, however, with the labia minora, which can be felt even at the moment of the exit, and greatest distension. The sufferings of the patient are now at their height, and the pains are frequently "*double*," a new one commencing before the former has quite terminated. The force is at length so great, that all resistance is overcome, and with a cry of anguish the exit is effected. There generally succeeds an interval of rest for a few seconds or more, then the pains again return, and the remainder of the child is expelled.

The second stage is now completed, and the woman is entirely free from pain. If the hand be placed upon the abdomen, it will be found flabby and relaxed, and the uterus can be felt through the abdominal parietes, large, and moderately contracted.

*The third stage* is occupied by the detachment and expulsion of the placenta; the period occupied in effecting this varies much in duration. Sometimes it is expelled with the body of the child; at others, it is retained for some time after. Usually, after an interval of ten or fifteen minutes, pains of a different character follow; by these the detachment of the placenta is effected, and it is extruded into the vagina. By the voluntary efforts of the woman, assisted by the contraction of the vagina, it is entirely expelled, and the *labour* is completed. Its expulsion is commonly accompanied by a gush of blood, from which circumstance these pains have been called *dolores cruenti*.

The placenta generally enters the vagina inverted, that is with its fœtal face looking outwards, and the bag of membranes is also turned inside out. Especially is this the case, if traction has been employed upon the cord. After the expulsion, the uterus, now emptied of its contents, contracts into a firm hard ball, which can usually be detected for some days above the symphysis pubis. In this state of condensation it is about the size of a fœtal head.

## PRESENTATIONS AND POSITIONS.

By the term *presentation*, we understand that part of the child which offers itself at the superior strait. By *position*, the relative situation of the presenting part to some cardinal point of the superior strait.

It will at once be seen that there may be a presentation for every square inch of the child's body, and a position for every degree in the circle of the superior strait. This, however, would lead to endless confusion; hence obstetrical writers have diminished the number greatly. Some make only *two* great presentations, viz., of the *head* and *breech*, looking upon all others as deviations from one of these.

include the above with their deviations, viz:
ıalic *presentations*, including any part of the head.
*ch or pelvic*, including the hips and loins.
*rior extremities*, including the knees and feet. Churchill.
*erior extremities*, including the shoulder, elbow
ıd hand.

ırs, such as the back, belly, and sides, are so exceedingly
hat it is not considered advisable to burden the student's
rith them, particularly as their treatment is the same as that
ılder presentations.

*diagnosis* of these different presentations may be described
ral terms, as follows, viz.:

he *head*, by its hardness, by the presence of sutures and fon-
s, and by its shape.

he top or *Bregma*, by the shape of the anterior fontanelle.

he *face*, by its irregular shape, by the orbits of the eyes, by
se, mouth, &c.

the brow, or forehead, by its shape, by the superciliary
and by the anterior fontanelle.

he *breech*, by its softness, by the nates, organs of generation,
ischii, and often by the meconium, by the *single* prominence
os coccygis, and by the sphincter ani muscle, which contracts
rritated by the finger.

he *knee*, by its rounded form, and by the condyles of the
and perhaps by the patella.

he *foot*, by its length, shape, position at right angles to the
the equal length of the toes, the heel, &c.

he *shoulder*, by its rounded shape, by the clavicle, the spine
scapula, the axilla, ribs, &c.

the *elbow*, by its sharpness, produced by the olecranon
.

he *hand*, by its shortness, the thumb and fingers, palmar and
aspect, &c.

ıgard to the *positions*, it is customary to note the relation be-
some point of the presenting part, and some other point in
m of the pelvis; for instance, the first position of the vertex
in which the posterior fontanelle is found behind the left
ılum. The different positions will be spoken of in treating
various presentations.

### MECHANISM OF LABOUR.

hen the long axis of the child's body corresponds with that
uterus, the child (provided the passages are round) can be
. that position; it matters little, so far as the labour is con-
which extremity of the child presents, so long as this is the
ıut where the long axis of the body does not correspond with

that of the uterus, the child must evidently lie more or less across, and will present, with the arm or shoulder, a position in which it cannot be born. In stating this, we wish it to be understood, that we merely refer to the full-grown living fœtus, and not to one which is premature, or which has been some time dead in the uterus, as these follow no rule whatever. Hence the positions of the child, at the commencement of labour, resolve themselves into two divisions, viz., where the median line of the child's body is parallel with that of the uterus, and where it is not."—*Rigby.*

*Vertex presentations.*—The vertex may present at the brim of the pelvis in various positions; some obstetrical writers enumerate as many as eight, others only four, whilst a third class take the intermediate number of six. The latter is the division of Baudelocque, and the one most generally adopted in the schools. These are as follows, enumerated in the order of their most frequent occurrence.

| | | | | |
|---|---|---|---|---|
| 1st. | Occiput at the | left acetabulum ; | Bregma at the | right sacro-iliac junction. |
| 2d. | " | right " | " | left " " |
| 3d. | " | symphysis pubis, | " | promontory of the sacrum. |
| 4th. | " | right sacro-iliac junction, | " | left acetabulum. |
| 5th. | " | left " " | " | right " |
| 6th. | " | promontory of sacrum, | " | symphysis pubis. |

Naegelé and others make four, leaving out the fifth and sixth. Rigby makes only two, viz., the first and second, whilst Ramsbotham, Flamant, &c., make eight, adding to those already enumerated, 1st, the face inclining to the right ilium, the occiput to the left, the right ear behind the symphysis pubis, the left towards the spinal column. 2d, the reverse of the first, face to the left ilium, occiput to the right, right ear towards the promontory of sacrum, left behind symphysis pubis. The remaining six follow in the order given above.

According to the table given above, the first three are called *occipito-anterior*, the last three *occipito-posterior*.

In regard to the *frequency* of these positions, it may be stated that Naegelé maintains that the *fourth* position of the vertex is much more common than the second, and that the fifth and sixth are so rare that they are discarded entirely by many eminent practititioners, they having never met with them.

*Cephalic presentations* are by far the most numerous of the varieties that offer themselves, and of these, those of the vertex in the first position occur most frequently. Madame Boivin states, that in supervising twenty-thousand five hundred and seventeen labours at the Maternité Lying-in Hospital, at Paris, she found fifteen thousand six hundred and ninety-three cases in which the vertex presented in the first position.

The greater frequency of vertex presentations may be readily accounted for. It will be remembered that the fœtus hangs sus-

l in the liquor amnii by the umbilical cord, which is attached
to its pelvic than its cephalic extremity; the head being the
st part, consequently becomes the most dependent.
her is it difficult to explain why the head in labour more
nly presents itself in the occipito-anterior, rather than in the
y way. The child in utero naturally lies on its back, with
d inclined downwards towards the orifice of the womb. The
iameter of the womb, at the end of pregnancy, and especially
commencement of labour, dips at an angle of about forty-five
s towards the horizon in a woman, who is sitting or standing
he child being in a complete state of flexion both as to its
nd limbs, would naturally roll, so as to bring that part of its
hich is convex, to adapt itself to the concavity of the womb.
ill of course be its back. The uterus at the same time rests
he abdominal muscles anteriorly, which form a soft cushion
The head can only pass the brim of the pelvis (superior
, by the adaptation of certain of its diameters to those of the
The longitudinal diameter of the child's head is four and a
ches, whilst the antero-posterior diameter of the superior
s only four: it must therefore adapt itself either to the oblique
transverse; of these, the oblique is most common. Suppose
a first position, in which the longitudinal diameter corre-
with the oblique of the superior strait, the vertex is behind
t acetabulum, and the forehead at the right sacro-iliac junc-
The two fontanelles will be at first on a level.
first step in the mechanism of labour is the *flexion of the head*,
approach of the chin to the breast. This is produced by the
of the uterus pressing the head downwards into the cavity.
pressed from above downwards, the spine causes the head to
rwards, so that the occiput sinks towards the centre of the
and the chin is squeezed firmly against the breast.
his movement, the diameters of the child's head are brought
rrespondence with such diameters of the pelvis as will allow
dy transmission. The occiput occupies the centre of the
r strait; the occipito-bregmatic diameter corresponds to the
diameter of the pelvis, which extends from left to right, and
efore backwards; the bi-parietal represents the other oblique
er; the occipito-mental is parallel to the axis of the pelvic
and the occipito-bregmatic circumference corresponds to the
f the strait.
follows *rotation*, by which is meant, the screw-like move-
f the head in the excavation, by which the vertex is brought
ymphysis pubis.
he continued action of the uterus, the head is pushed into the
ion until it reaches the floor of that cavity; here its progress
ted and the direction changed by the gliding of the occiput

upon the left anterior inclined plane, from behind forwards and from left to right, so as to place itself behind the symphysis pubis. Whilst the vertex is executing this movement, the forehead glides from right to left, and from before backwards, on the right posterior inclined plane, so as to fall into the hollow of the sacrum. In executing this rotation, or pivot motion, the head turns upon its long diameter.

The third stage is *extension*, which signifies the departure of the chin from the breast.

This commences as soon as the occiput begins to emerge, and is completed when the child's head is entirely born. Instead of continuing to bend forwards, the head now tends to turn over backwards, so as to bring the occipito-mental diameter into correspondence with the axis of the inferior strait.

After the head is fairly engaged in the inferior strait, it is no longer in the same relation to the diameter as before; its great diameter and occipito-bregmatic circumference, however, have not undergone any change, for we find, that at the inferior strait, as well as at the superior, they still represent the plane and axis of that strait. The bi-parietal diameter corresponds to the transverse of the inferior strait, and the occipito-bregmatic to the antero-posterior. The great end of *rotation* is to produce this relation between the diameters, to effect the exit of the child's head.

The last stage is *restitution*, by which is meant, the turning of the vertex again to that side of the pelvis, towards which it was directed before the labour began, or before rotation took place. As soon as the head is born, all restraint is taken away from it, and as it is incapable of retaining the twist which brought it under the arch of the pubis, it returns to its natural position upon the shoulders, which had been temporarily changed. In the position now under consideration, the vertex turns towards the left thigh of the mother, and the chin to the right. A short interval of ease succeeds the birth of the head, after which the shoulders enter the excavation. They also enter obliquely, and perform the rotation as above described. The right shoulder is behind the right acetabulum, and rotates from right to left on the right anterior inclined plane towards the symphysis pubis; the left is at the left sacro-iliac junction, and rotates from left to right on the left posterior inclined plane into the hollow of the sacrum. The right shoulder generally appears first at the pubic arch, whilst the left escapes over the perineum; the vertical axis of the child's body is bent, so as to accommodate itself to the axis of the pelvis, which, it will be remembered, is a curved line. After the shoulders emerge, the rest of the body is expelled without anything peculiar to demand description.

In the *second position* of the vertex, the mechanism differs but little from that of the first; the same forces are brought to bear upon the child, and the same diameters offer themselves to the prin-

ameters of the pelvis; the head also executes the same move-
ts in the preceding. The vertex, however, in this case, is
the right acetabulum, and rotates from right to left on the right
r inclined plane, and the forehead on the left posterior inclined
nto the hollow of the sacrum. At the inferior strait there is
rence between the two positions; but after the escape of the
he vertex turns towards the *right thigh*, the left shoulder
nder the arch of the pubis, and the right falls into the hollow
sacrum; but in these changes there is no variation from the
ional relations between the fœtal head and the maternal

is considered by some obstetricians as not so favourable a
n as the first, in consequence of the impediment offered by the
to the rotation; this is not believed to be a valid objection,
rectum can be easily emptied, and then offers but a slight
e.
*third position* is confessedly so rare that some obstetrical
have banished it entirely. Baudelocque admitted it rather to
his plan, than from any evidence of his senses. Madame
met with it only six times in twenty thousand five hundred
enteen cases. Velpeau also is sceptical as to its existence.
n it does occur, its mechanism is a little different from the
ng; the occiput is at the pubis, and the forehead at the pro-
y of the sacrum. In this case, the occipito-mental diameter
onds with the axis of the superior strait, and the occipito-
tic circumference with the plane of that strait.
bi-parietal diameter, however, is situated transversely, and
ipito-bregmatic from front to rear. There is no rotation ne-
in this case, and none occurs, consequently there is no resti-

shoulders commonly enter transversely, although they gene-
nerge with one at the sacrum and the other at the pubis,
; our being able to tell beforehand which it will be. In the
the labour there is nothing peculiar.
*fourth position* of the vertex is the most common of the occi-
sterior varieties. In this position the same diameters corre-
s in the first; but, the situation of their extremities is re-
Engagement takes place more easily, and the head descends
e excavation more readily than in the occipito-anterior posi-
ntil it reaches the floor of the pelvis. Instead of extension
g readily now, a greater degree of flexion is demanded, so as
le the occiput to rotate into the hollow of the sacrum, which
from right to left, upon the right posterior inclined plane,
he forehead, or anterior fontanelle, slides forward upon the
erior inclined plane, from left to right.
vertex is born first, over the perineum, and extension takes
ckwards, so that the posterior fontanelle, the sagittal suture,

the anterior fontanelle, the parietal protuberances, and the several parts of the face, are successively seen in front of the perineum. Immediately after the birth of the chin, restitution takes place; the face turns towards the left groin, and the occiput towards the posterior part of the right thigh of the mother.

The left shoulder rotates to the front under the symphysis pubis, while the right falls into the hollow of the sacrum.

M. Naegelé states that this position is more common than the second, and that rotation takes place from behind forwards, so as to bring the occiput under the pubes, instead of into the hollow of the sacrum, as already described. In this opinion he is confirmed by Professor Meigs.

In the *fifth position*, the back of the child is directed to the left and backwards, the right shoulder to the left and forwards, and the left, to the right and backwards; the bi-parietal diameter corresponds with the left antero-posterior oblique, and the occipito-bregmatic with the right antero-posterior oblique diameter; the lesser circumference of the fœtal head, and the occipito-mental diameter, are parallel with the plane and axis of the strait. Rotation of the vertex takes place upon the left posterior inclined plane, into the hollow of the sacrum, while the forehead, gliding upon the right anterior inclined plane, is brought to the symphysis pubis.

After the birth of the head, *restitution* takes place, with the occiput to the inside of the mother's left thigh, while the face looks towards the right. This is said to be a more difficult position than the preceding, in consequence of the presence of the rectum, which retards the progress of the occiput.

In the *sixth position*, as in the third, there is neither rotation, nor restitution; the occipito-bregmatic diameter corresponds with the antero-posterior, and the bi-parietal with the transverse.

It is less favourable than the corresponding oblique positions, in consequence of the liability of the forehead and face to be turned downwards, and thus permit the long diameter of the head to be brought into parallelism with the short diameter of the pelvis.

In all these occipito-posterior positions, there is much greater distension of the perineum than in the occipito-anterior, in consequence of the head having to descend lower; they are therefore more tedious and painful.

It is by no means an easy matter to diagnosticate the *positions* of the vertex; it requires great delicacy of touch, and considerable experience. The movements of the child, and the stethoscope, are valuable assistants to the sense of touch. Naegelé observes that when the movements are felt most on the right side, the head is probably in the *first* position, when on the left, in the *second*.

The stethoscope also informs us of the situation of the fœtal heart, and when this is decidedly known, it becomes an easy matter to define the position of the head.

### CONDUCT OF A LABOUR.

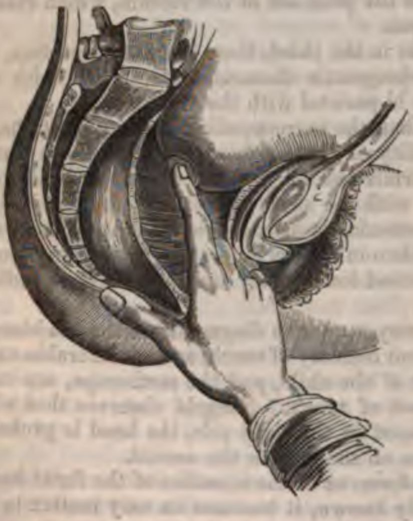
The conduct of a labour includes all that is done for a parturient patient from the beginning of her pains till the uterus is emptied, and the safety of both mother and child secured. It is not to be understood by this, that the accoucheur is to substitute himself for nature; on the contrary, he really has little to do in most cases, except to receive and protect the child, to deliver the placenta, and watch over the mother and her offspring for some hours after the delivery.

Whilst thus he is ready to let nature assist herself, he must be prompt to recognise and avert any danger that may arise.

It is well for the practitioner always to be provided with a lancet and an elastic male catheter; and if he live in the country, with a little laudanum. The first duty of the attendant is, to ascertain *her present condition, whether in labour or not*, and if so, *how long she has been in labour, the nature of the presentation, the rate of progress, and probable termination.*

The first conditions will be readily discovered, by examining the skin, pulse, tongue, &c.; then directing the attention to the pains, noting their character, frequency, duration, &c., the character of the outcry, the gestures of the patient, and the state of the vaginal discharge. By these symptoms he will be enabled to judge of the existence of labour or not, the stage and rate of progress, and also of the necessity for a more particular examination.

Fig. 21.



One of the first duties of the practitioner, after the above inquiries have been attended to, is to discover the condition of things by a per vaginam examination; this, it need hardly be said, should always be proposed in the most delicate manner. There is much information to be gained during the first examination (and it should *never* be *needlessly* repeated); first, whether she be really pregnant; secondly, if she be in labour;

thirdly, whether the membranes have ruptured or not; fourthly, the nature of the presentation; fifthly, the stage and progress of the labour; sixthly, the state of the os uteri, vagina, and perineum; he is also to take the opportunity of estimating the capacity of the pelvis, and other circumstances which may influence the duration of the labour. (Fig. 21.)

It is scarcely necessary to repeat this examination during the first stage, if all is right; but in the second, it should be regulated by the rapidity of the advance, and when once the head has reached the perineum, the finger should be kept upon the head during each pain, so as to regulate the amount of support for the perineum. The finger ought always to be introduced *during* a pain, but the examination should also extend to the *interval.*

During the first stage, the patient need not be confined to the bed, but may be allowed to sit up, or even to walk about, if she desire it. Neither is it incumbent upon the medical attendant to remain in the lying-in room during the first stage; his presence may be a restraint upon the patient.

The condition of the bowels should always be early attended to, and if they have not been acted upon lately, should be unloaded either by an enema, or an aperient. The bladder should also be emptied, either spontaneously, or by the catheter. The diet of the patient, when the first stage is protracted, should be of a light, unstimulating character; the object being to sustain nature while under a severe effort, at the same time that we carefully avoid calling that effort in the direction of the digestive organs.

There should always be in readiness several strong ligatures for the cord, a pair of sharp scissors, some strong pins, and a "binder," or broad bandage for the female. It is likewise the duty of the accoucheur to see that the bed is properly prepared for the patient. This is best done by spreading a piece of oiled cloth upon the mattress to protect it at the point the patient is about to occupy; over this may be placed several blankets or coverlets, folded square, to receive the discharges, &c. These latter can be easily removed after the labour is completed, without disturbing the patient, leaving the bed-linen beneath unsoiled.

The *second stage* is often announced by the rupture of the membranes. As soon as this occurs the patient should retire to her bed, and the practitioner make an examination, in order to determine more accurately the position, and inform himself of the advance of the head.

In this country and in England, it is usual to place the woman upon her left side, with her hips close to the edge of the bed, and her knees drawn up towards the abdomen. The position enables the practitioner to use his right hand with advantage, and is also supposed to favour the engagement of the head in the first position.

If the membranes have not ruptured at the commencement of this stage, and the head has passed the circle of the os uteri, they may be broken either by pressing the finger upon them during a pain, or by means of a probe passed along the index finger, provided always, that it is not a first labour, and the attendant is satisfied that their usefulness as a dilating agent is at end.

When the head has reached the floor of the pelvis, and is beginning to distend the perineum, the latter should be supported by the palm of the left hand (guarded with a soft napkin), in such a way as to delay the passage of the head slightly, and to bear it towards the pubis, so as to prolong the curve of the sacrum, and make certain of the head being carried forward to the anterior orifice of the vagina, and not allowed to perforate the perineum for want of a just support.

As the head escapes from the os externum, it should be received in the hand of the practitioner, and allowed to perform the motions of restitution, carrying it forward as the shoulders are expelled; he should also be careful to observe whether the cord is twisted about the neck, and if it be to disengage it. The perineum should be supported during the exit of the shoulders, and the whole body carried forward in the axis of the pelvic outlet, and not by any means *pulled out*, in order to relieve the woman from pain, and facilitate the delivery.

When the child is entirely born, and respiration is established, or the cord has ceased to pulsate, it may be separated from the mother. To do this, one strong ligature should be tightly tied around the cord about two inches from the umbilicus, and another about an inch further on, and the cord cut between them. The two ligatures are useful in case of twins, which sometimes have a common placenta, and also for the sake of cleanliness.

The accoucheur should then place his hand on the abdomen of the mother, for the purpose of ascertaining whether there be a second child or not, and also to discover, from the state of contraction of the uterus, whether the placenta be discharged or not.

If the uterus be well contracted, the placenta will probably be found in the vagina; as soon as it has descended so low that he can feel the insertion of the cord, he may withdraw it by gentle traction in the axis of the vagina. No force should be used in this operation, for fear lest the placenta should be still adherent, and thus the risk of inversion be produced, or the cord torn from its insertion. The pudendum should now be carefully and gently dried, and covered with warm napkins; after which the binder should be so applied as to extend from the pubes to the ensiform cartilage, and drawn moderately tight, thus affording an adequate support for the uterus and abdominal viscera.

The wet sheets, &c., may now be removed from under her, and the patient covered over to prevent chilliness, and then left to have an hour's rest before she is made comfortable in bed.

The child should be put to the breast as soon as the mother is sufficiently rested. It is not only useful to the child by supplying it with the early secretion, which is laxative, but it is also beneficial to the mother, inasmuch as it excites contraction of the uterus.

The diet of a woman lately delivered should be as light as possible, consisting mainly of the farinaceous articles; and she should be kept in a strictly horizontal position till all danger of hemorrhage has passed.

About half an hour after the labour is completed there often occur a succession of painful contractions called *after-pains*. During their presence, the discharge from the uterus increases and coagula are frequently expelled; their operation is salutary within certain limits, they prevent hemorrhage, diminish the size of the uterus and expel its contents; they are rare in primiparous women. If very severe they may be diminished by small doses of camphor and opium.

The *lochia* is the name given to the discharge that continues after labour is completed. For some days it retains the character of blood; but it finally loses its firmer portions and red globules, in consequence of the continued contractions of the uterus, and becomes of a greenish tint. It comes from the patulous orifices of the vessels on the uterine surface where the placenta was attached, and disappears as these become compressed by the uterine contractions. It usually lasts three weeks, though sometimes longer.

General directions have been given for the management of the child after birth; it sometimes happens that it requires further attention at the hands of the practitioner, owing to some pathological condition into which it may have fallen. For instance, when born it may be in a state of *defective vitality*, *asphyxia*, or *apoplexy*. The first condition may be produced by excessive uterine hemorrhage, by too early a detachment of the placenta, or by defective nutrition. This will be recognised by the feeble efforts at respiration, and the weak and irregular action of the heart. Under these circumstances no advantage is gained in preserving the connexion between the mother and child; the cord should be tied and cut, and the infant immersed in a warm bath of the temperature of 97° or 98° Fahr. If after a few minutes, the child does not gasp, and we observe that the heart is acting less forcibly, a longer continuance in the bath will do harm; it should, therefore, be removed, and cold sprinkling tried, or what is better, gentle stimulation by means of frictions over the general surface, and, if necessary, artificial respiration.

In the *second condition*, the child is sometimes asphyxiated by pressure upon the cord, or by being delayed in the passage in a te-

abour. Here it would be obviously improper to cut the cord;
ctitioner should resort to frictions, cold aspersions, or water
from a height upon the epigastric region, artificial respira-
c. Should these means fail, he may try the effect of bleed-
r cutting the cord and allowing about a table-spoonful of
o escape; if this is unsuccessful, the case is probably hope-

*third condition* is most frequently produced by long-conti-
ressure, or, from an interval elapsing between the birth of
d and that of the body. Under these circumstances, the ac-
the heart is weak, and the pulsation in the cord feeble and
ed, the surface is blue, and the face livid; and, occasionally,
ens that the form of the head is altered. Bloodletting is
viously indicated, and it should be done by cutting the cord
lowing from half an ounce to an ounce to escape; when it
nerally be found, that the surface becomes of a natural hue,
se quicker and firmer, and an attempt is made to respire. If
ild does not breathe, a sudden puff into its face, or a slap
he buttocks, will often establish respiration, or the means
nentioned may be resorted to.

tumour that is often found upon the scalp of new-born chil-
alled *caput succedaneum*, and which is produced by the ex-
tion of blood, or effusion of serum beneath it, generally dis-
s spontaneously, or by the application of spirit or some sti-
ng lotion.

*orrhage from the navel after the separation of the cord* is
nes very troublesome, and may be treated by means of
ents, cautery, compresses, &c.; if these means fail, Dr.
ill recommends to stretch open the navel and fill it with
of Paris, either dry or moistened, allowing it to remain till
Others propose to cut down upon the vessel and tie it. A
rmidable operation has been successfully practised in this
y the late Dr. J. M. Wallace, by passing two needles through
vel parallel with the surface of the abdomen, and at right
to each other, and applying a ligature beneath them, as in
ration for aneurism by anastomosis.

### TEDIOUS LABOUR.

labour is often prolonged beyond the usual limit by a delay
of the three stages, and yet may be completed without either
or instrumental assistance.

e *first stage* it often depends on an undilated os uteri; this
equently occurs with first labours, and also in women of ad-
age, than under other circumstances. On examination, the
i is found in one of two conditions, either thin and hard, or
lpy and œdematous, and but little influenced by the pains,

which may be frequent and very severe. It may also be undilatable from the presence of cicatrices.

One of the most effectual remedies for this condition is venesection, which may be carried sometimes to a great extent, provided there be no contraindication. Dr. Dewees once took away as much as two quarts. The blood should be drawn rapidly and from a large orifice; if the patient becomes faint, so much the better. The bloodletting may be assisted by an opiate enema, by the administration of tartar emetic in nauseating doses, or by the application of belladonna ointment to the cervix. The warm bath has been recommended by some practitioners and disapproved of by others. Moral influences have, at times, a good effect; changing the dress, or the bed, changing the position, &c., are often of service. Some practitioners recommend mucilaginous injections to be thrown into the vagina.

There is another condition of the os uteri which is often a cause of delay, where the anterior lip is caught between the head and symphysis pubis and its retraction prevented. This may result either from an obliquity of the uterus, or more probably from an unequal dilatation of the anterior and posterior lips, the latter dilating most rapidly.

The remedy is simple and easily applied. During the interval between the pains, when the os uteri is soft and dilatable, the practitioner should gently push back the anterior lip over the crown of the head and hold it there during the succeeding pains,—a proceeding which, if nicely accomplished, will soon be followed by the expulsive pains of the second stage.

*Premature rupture of the membranes.*—This may occur either through their own weakness, or from violence, either accidental, or from the officious meddling of the accoucheur. The result is, that the os uteri, instead of being dilated by the bag of membranes, which is soft and wedge-like, comes at once in contact with the child's head, which is not by any means so good a dilator. The only remedy is patience. An examination should be made early, in order to correct the presentation without loss of time, should it be abnormal.

*Excessive quantity of liquor amnii* is sometimes enumerated as a cause of tedious labour; and this is apt to be in excess when the patient is feeble, and the child small and ill-nourished. The treatment for this is rupture of the membranes; but it should not be practised without due caution, or it may produce tedious labour from the cause mentioned in the preceding paragraph.

In the *second stage*, the labour is often rendered tedious by the feeble and irregular action of the uterus; when this exists, the interval between the pains is long, and the pains themselves are feeble and short, and have little or no effect on the child. This

f things is not uncommon in delicate women, or in the
; or it may be produced by mental depression, a deranged
f the digestive organs, or, it may arise from hereditary trans-
i.

ie treatment of these cases, it is above all things necessary to
p the patient's spirits; all causes of irritation should be re-
and she should be allowed to change her position. In some
; may be right to administer an opiate, so as to recruit her by
ind in all cases a stimulating enema will be found of service,
lly if the bowels are loaded, and the delay depend on this
But the most effectual remedy in these cases, is the *ergot of*
remedy which seems to possess a power of certain, direct, and
action on the uterus, causing it to contract almost unremit-
till its contents are expelled. Besides the power of strength-
eeble pains, Dr. Ramsbotham has shown that it is capable of
*iting* uterine action.

ay be given either in substance, infusion, or tincture, in the
from fifteen to twenty grains of the powder, till a drachm is
half a fluid-drachm to one fluid-drachm of the tincture; or,
ie quantity of powder as above directed, mixed in hot milk
e.

, however, to be given with caution, as results fatal both to
and child have followed its injudicious administration.

indications for giving it are, according to Dr. Churchill, 1st,
and inefficient pains without especial cause; 2d, if the os
e soft and dilatable; 3d, if there be no other obstacle to a
delivery; 4th, if the head or breech present, and are suffi-
advanced; 5th, if there be no threatening head symptoms,
essive general irritability.

on the other hand, it should not be given, 1st, if the os
e hard and rigid; 2d, if the presentation be beyond reach;
here be a mal-presentation; 4th, if the pelvis be deformed;
there be any serious obstacle to delivery in the soft parts;
h, if there be head symptoms, or much general irritation.

*hness of the membranes*, even after the os uteri is dilated, is
nes a cause of tedious labour; but, when once ascertained, it
of an easy remedy; if the pains are active, and the os uteri
, they may be ruptured without ceremony. The practitioner
cut a notch in his finger nail, and *saw* through the mem-
at the most dependent part, during a pain.

etimes they protrude unbroken, down to the os externum, and
e few cases, the child has been expelled with the bag of
anes and placenta *en masse;* under such circumstances, it
ertainly be drowned in its own liq. amnii if assistance were
hand to rupture them, and enable the child to breathe.

*dity of the soft parts* is a very common cause of delay in women who have borne children late in life, or who are of a plethoric condition, with a well-developed muscular system. In such, the head makes little or no progress, although the pains be strong and frequent. If this condition of things last long, the patient will fall into a state of exhaustion or constitutional irritation; or inflammation and sloughing of the soft parts from long-continued pressure will ensue.

The indications in the treatment are, 1st, to *gain time*; 2d, to *counteract inflammation*. These will be fulfilled by a moderate bleeding, if the constitution will bear it; by a dose of opium, to moderate or suspend the uterine action; and by small doses of tartar emetic, with the hope of relaxing the system. To these means may be added, warm hip-baths, warm mucilaginous fomentations to the parts, and the introduction of unirritating unguents into the vagina.

If the rigidity be dependent upon the presence of *cicatrices* of the os uteri, vagina, or perineum, the result of laceration or sloughing in former tedious labours, or occasioned by the ill use of instruments, the same rules for treatment may be adopted.

The uterus may acquire an *inclination* one way or another, during pregnancy, from different causes, and this oblique position of the organ may be a cause of delay in the progress of the labour. In women who have borne many children it is often owing to relaxation of the abdominal muscles, which permits the uterus to fall forwards, and thus the child's head, instead of being propelled into the brim of the pelvis, is driven back against the upper part of the sacrum. The nature of the obliquity is detected by a per vaginam examination, which reveals the position of the os uteri; if it be *lateral*, place the patient on the *opposite* side; if *anterior*, let her lie on her back, and support and draw up the fundus uteri by means of a towel or napkin passed beneath the pendulous belly and fastened behind the back, until the head shall occupy the inferior strait.

There are various other causes that may render a labour tedious, such as an over-distended bladder, or a rectum filled with hardened fæces, a rheumatic condition of the uterus, tumours, and deformities of the pelvis, &c. In the first case, the remedy is found in the introduction of the catheter and drawing off the water; in the second, a stimulating injection should be given, or, if necessary, the hardened fæces removed with the handle of a spoon; in rheumatism of the uterus, the patient generally complains of feverishness and restlessness, the abdomen is tender, the urine scanty and high-coloured, for some time before labour sets in. The contractions of the uterus are rendered exceedingly painful, and at times inefficient. The treatment consists in bloodletting, warm fomentations, an aperient of mag. sulph. and sodæ carb., and alkaline drinks.

ıours and deformities of the pelvis require instrumental aid, ıder an otherwise natural labour, preternatural.

## ESENTATIONS OF THE BREGMA, OR TOP OF THE HEAD, AND OF THE BROW.

entations of this portion of the head are dependent upon a ıre of the chin from the breast, and are regarded as devia- 'om an occipital presentation. There are the same number of ns of this presentation as in those of the occipital, viz.:

| | |
|---|---|
| tex to left acetabulum. | Forehead to right sacro-iliac junction. |
| " right acetabulum. | " left " " |
| " symphysis pubis. | " promontory of sacrum. |
| " right sacro-iliac junction. | " left acetabulum. |
| " left " " | " right " |
| " promontory of sacrum. | " symphysis pubis. |

diagnosis of this presentation is readily made by discovering adrangular fontanelle, occupying the centre of the opening. rious positions engage less readily in consequence of the head ; a larger surface to the os uteri, and because the occipito- diameter cannot readily descend into the excavation while the ːss of the walls of the neck of the uterus is added to it. scovered before the head has engaged, it may be corrected by g up the forehead and pulling down the occiput. Should the ave descended, however, the movements of flexion and rota- ould be aided by the hands of the practitioner.

ll cases where the anterior fontanelle offers itself originally, s a natural inclination for the case to be converted into a face presentation; and this is owing to the fibres of the uteri exerting themselves strongly upon the fœtal body; which action the shoulders are pressed downwards, the chin ually separated more and more from the chest, and the head lled in the manner hereafter to be described.

should endeavour to place the head in a more favourable posi- y throwing the chin more upon the chest, and causing the to descend; provided this could be accomplished without ng danger, without any aggravation of suffering, and without midable appearance of preparing for an operation. This ob- ı frequently be gained, if the position be detected soon after pture of the membranes, and before the head has perfectly d in the pelvic cavity, by a very simple and easy method; requires that steady pressure should be made upon the brow e extremity of the finger during the urgency of pain, so that ehead may be arrested at the spot to which it has attained, powers of the uterus be expended upon the back part of d. It is then usually observed that the head is bent forward on the neck, as on a hinge; the vertex comes down, the brow remains stationary; and thus the case may be made one of the most simple, natural, and easy.

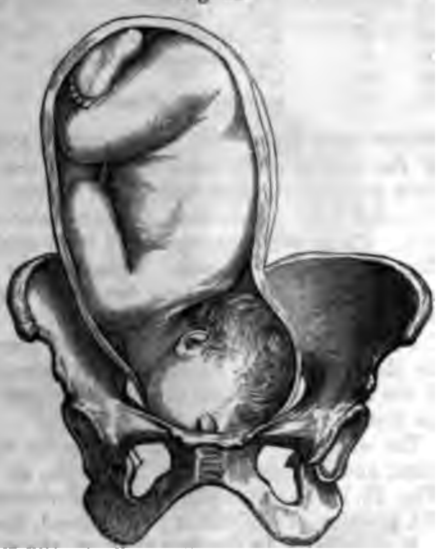
The attempt should only be made during the paroxysm of pain: it is not possible to *push* the anterior fontanelle *up above* the brim; the only intention should be to prevent it passing *down further*, and to give an opportunity for the back part of the head to occupy the pelvis more completely. This counter-pressure, nevertheless, must be made with caution, tenderness, and judgment.*

## FACE PRESENTATIONS.

Face presentations are deviations from those of the occiput, and are not by any means as dangerous as they were formerly supposed to be. Madame Lachapelle has laid it down as a fixed principle, that this sort of labour is nearly as easy and as natural as that by the vertex, and affirmed, that out of seventy-two cases of this kind, forty-two were delivered by the unassisted efforts of the female, without danger either to mother or child. They are therefore included under the head of *Natural Labour.*

The *causes* of face presentations are obscure, and have been variously described by authors. Some suppose that they are caused by the inclination or obliquity of the fœtus itself, rather than of the organ which contains it. Madame Lachapelle attributes them to the circumstance that the anterior obliquity of the womb being very common, the weight of the occiput must in such cases prevent the chin from being applied to the breast; and must bring the mento-bregmatic diameter into parallelism with the sacro- diameter, from ry commencement e labour. Paul ts they are

Fig. 22.



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* Ramsbotham's process of Parturition.

ive, and probably produced by the active movements of etus itself, and the following is his explanation. "At any uring gestation, the chin may depart from the breast; if the retains this position till the end of pregnancy, it becomes per-tly fixed in it at the commencement of labour, by the rupture membranes, and the contractions of the uterus."

most authors, obliquity of the uterus has been looked upon principal cause of face presentations. If at the commencement our the uterus is so oblique as to throw the fundus far over to ght side, the child presenting by the head and the vertex in the osition, the direction of the expulsive force operating on the will propel its head against the edge or brim of the pelvis, ther cause it to glance upwards into the iliac fossa and let the er come down, or it will be turned over, so as to let the face to the opening, and thus produce a face presentation, in which in will be directed to the right side, and the forehead to the the pelvis. (Fig. 22.)

ill therefore be seen, from this explanation, that face presenta-re deviations from those of the vertex. From this circumstance uthors make the same number of positions for them as for presentations, as follows :—

| | |
|---|---|
| rehead to left acetabulum. | Chin to right sacro-iliac junction. |
| " right " | " left " " |
| " symphysis pubis. | " promontory of sacrum. |
| " right sacro-iliac junction. | " left acetabulum. |
| " left " " | " right " |
| " promontory of sacrum. | " symphysis pubis. |

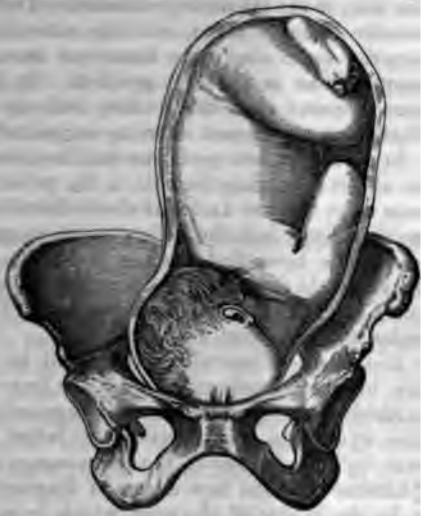
again make four, corresponding to the four *oblique* positions vertex, while some enumerate the same number, disposing *ransversely*, and from *front to rear*, admitting a *right mento-* nd a *left mento-iliac*, a *mento-pubic* and a *mento-sacral posi-* These positions having all been established, it is proper that ould be mentioned. Presentations of the face, however, are always resolved into two only, viz., right mento-iliac and nto-iliac, as follows :

*t position.*—Forehead to the left ilium, or left acetabulum, and n to the right ilium, or right sacro-iliac junction, the bridge nose representing the line described by the sagittal suture in t vertex position. (Fig. 22.)

*second position.*—Forehead to the right acetabulum, or right and the chin to the left ilium, or left sacro-iliac junction. 3.) The first position is a deviation from either the first or sition of the vertex; the second, from the second or fourth.

*anism.*—In the first position, the right side of the face is an-and therefore more depressed than the other on entering m, and the finger touches the right eye or zygoma first, on

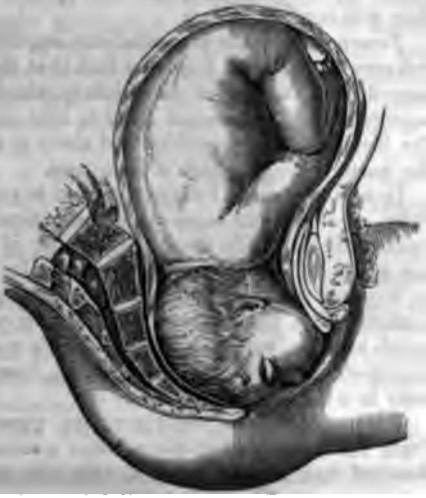
Fig. 23.



g an examina-
if the labour is a
one, this part of
ce is swollen and
The face comes
transversely with
-malar, or rather
bi-temporal dia-
, in coincidence
the antero-pos-
of the superior
and the fronto-
l with the trans-
As the head is
down into the
tion, *extension*
ecomes as great as
le, then the chin
upon the right
or inclined plane
it gets under the
f the pubes; while
terior fontanelle
in an opposite direction upon the left posterior inclined plane,
lls into the hollow of the sacrum. As the chin emerges, it
up towards the
veneris, perform-
this case the
ent of *flexion*,
l of *extension*, as
tex cases; the
d, followed by
gittal suture and
, passes gradu-
own the plane
ted to it by the
r surface of the
and perineum,
nt of which all
parts are succes-
lisengaged. (Fig.

*d position*
reverse of
left side
rds,
and

Fig. 24.



are lowest in the pelvis, and the ecchymosis is found on
le, if the labour is protracted. The chin rotates upon the left
r inclined plane, and the anterior fontanelle on the right
or one: the same diameters correspond, and the labour is
ted as in the first position. It is said that this position is
requent than the former, and that rotation is more readily
l, as the rectum offers no impediment.

ll the various positions that have been described or alluded to,
ect is to bring the chin to the pubis, and the mechanism is the
s in the two varieties above described. Should this fail, and
n rotate into the hollow of the sacrum, it is impossible for this
be born first (unless the fœtus be an abortion); for the
would then be in the pelvis at the same time as the head, and
require assistance to deliver it. These cases will be treated
*Preternatural Labour.*

*gnosis.*—Generally speaking, it is not difficult, although the
as been confounded with the breech. It is generally distin-
d by the prominence and regularity of the features, by the
yes, chin, and mouth; the latter is distinguished from the
y the absence of the prominence of the coccyx, and by the
ter ani; the best means of diagnosticating face presentations
he bridge of the nose, which from its *crossing* the os uteri
detected at a very early period of labour; it is better than
e, which may not only be injured, but may mislead; it is
than the malar bones, for these may be mistaken for the tuber
or even for the shoulder. The nose not only tells the pre-
on, but also the *position.* After the face has descended, the
ill confirm it.

*tment.*—Face presentations require more laborious effort for
y than others, from the fact that the cephalic extremity is re-
from the line of direction in which the uterus and accessory
act. The second stage is also longer, because the bones of
e are incompressible, and there is not the same adaptation to
rts through which it is to pass.

rdinary cases little is required beyond watching the case care-
cheering and supporting the patient. If called early enough,
our to rectify the presentation; if not, to bring the chin to
bis by the gentlest assistance. In most cases no interference
ired; the general rules already given are sufficient. The
s of a child born under a face presentation are generally
swollen, turgid, and livid. We must be prepared, therefore,
ct some disfigurement, which, however, will generally disap-
a day or two.

*r deviations* from the vertex presentations sometimes occur
he operation of the same or similar causes. The head may
d half turned over, so that the occipito-frontal, or occipito-

mental diameter corresponds to those of the straits, as shown before (p. 78). In this case either the anterior fontanelle or forehead will be the presenting part. Sometimes the head is too much flexed, occasioning a part of the nucha to present with the occiput. Again, it frequently happens that one of the parietal bones, or the ear, or the temple, being nearly parallel with the plane of the superior strait, engages first. Such cases may either correct themselves, or become the cause of preternatural labour.

## PELVIC PRESENTATIONS.

Under the head of pelvic presentations are included those of the knees and feet; it matters but little, so far as the mother is concerned, which end of the fœtal oval presents at the superior strait, since either can be born unassisted. These pelvic presentations are, however, more dangerous to the child than cephalic, either from the fact that the placenta is often detached from the uterine surface before the head is born, or from pressure upon the umbilical cord during the exit of the head, either case being attended by the same result, viz.: *asphyxiation of the child*. All practitioners agree that the child is oftener born dead in pelvic presentations, than in those in which the vertex descends first.

*Causes.*—Breech labours occur once in about every forty-five or fifty cases; why they occur this often, or why they happen at all, appears to be inexplicable. Madame Lachapelle explains their occurrence as follows:—During a great part of gestation, and whilst the fœtus is still movable in the cavity of the uterus, its long diameter can be readily brought into coincidence with the transverse diameter of that organ; its position therefore is by no means fixed, and it can, by virtue of its active movements, present any part of its surface at the uterine orifice, but especially the cephalic or pelvic extremities. The latter part may occupy the superior strait at any period of gestation, in consequence of the movements of the fœtus, and may remain in that situation for an indefinite period. It happens then, if the fœtus in this time should have developed itself to any extent, it cannot turn, and it will be apt to retain the attitude it may then acquire till the end of pregnancy, as its length does not readily admit of its passing the transverse diameter of the uterus.* Violent movements on the part of the female, it is thought, may also be a cause of pelvic presentations, but, as before stated, they are in the great majority of cases, inexplicable. Some women, from original conformation or other causes, appear ularly obnoxious to this mischance, bringing all their children he world by breech labours.

*nosis.*—Breech labours are generally more tedious than ce-

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* Traité Pratique de l'Art des Accouchemens, p. 604.

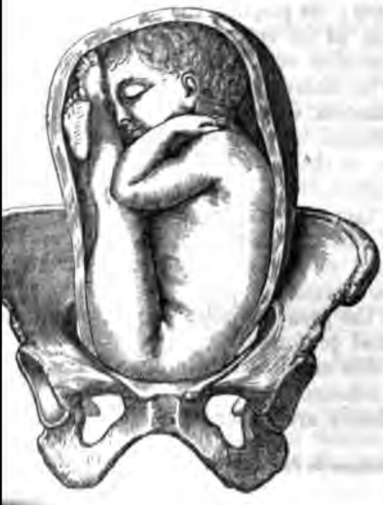
, inasmuch as the pelvic extremity is not so good a *dilator* as phalic; it never presents the same evenness, the same resist- or the same rounded form as the head to the openings of the ; it consequently acts to much less advantage on the cervix to its dilatation. In vertex presentations the most voluminous that which is best calculated to bear all kinds of pressure, es- first. In pelvic presentations, on the contrary, the point of one advances first, so that the fœtus progresses more slowly in rtion as the labour advances.

*itions.*—The same difficulty occurs in enumerating the various ons of the breech that we have seen obtain in the other pre- tions, every author recording those which seemed to him best ished. Thus some make as many as eight; among these is M. ant, who makes one for each extremity of the different diameters superior strait, viz.: two for the antero-posterior, two for the *erse*, and two for each of the oblique, making eight in all. s make six, corresponding to the different positions of the , the sacrum taking the place of the vertex, as follows:—

| | | | |
|---|---|---|---|
| rum to | left acetabulum. | Post. part of thighs to | right sac.-iliac junction. |
| " | right " | " | left " " |
| " | pubes. | " | prom. of sacrum. |
| " | right sacro-iliac junction, | " | left acetabulum. |
| " | left " " | " | right " |
| " to | sacrum " " | " | pubes " |

find, again, some reducing them to four, viz.: 1st, sacrum to the left acetabulum, 2d, to the right acetabulum, 3d, to the pubes, 4th, sacrum of the child to the promontory of sacrum of the mother. Thus the direct positions, either anterior or posterior, are possible, as well as the diagonal ones, and the breech *may* present in as many ways as the head.

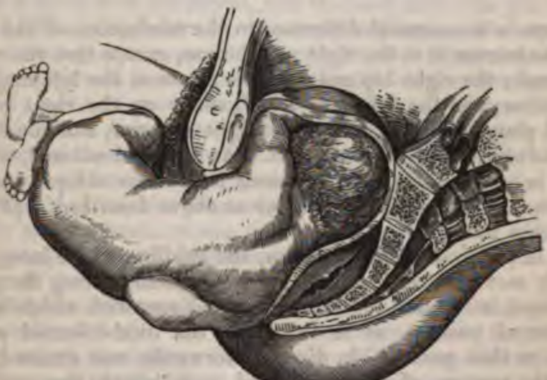
Fig. 25.



To simplify the matter, however, most of the recent writers reduce them to two, viz.: *sacro-anterior*, and *sacro-posterior*, that is, the back of the child towards the belly of the mother, and the back of the child towards the back of the mother. Not that the back of the child is *directly* anterior or posterior, but oblique, the transverse diameter of the child's hips corresponding to one or other of the oblique diameters of the superior strait. (Fig. 25.)

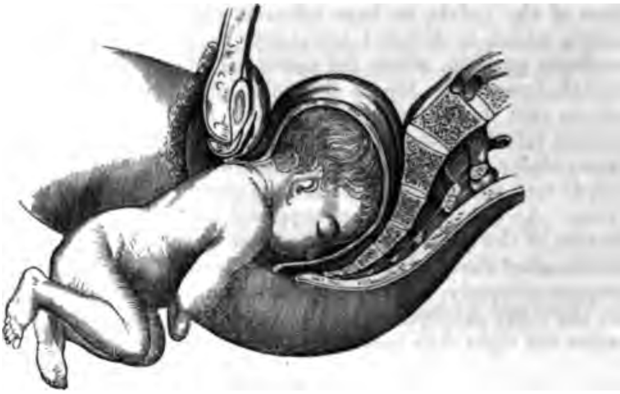
*Mechanism.*—The mechanism of the sacro-anterior positions is so much alike, that but one description will be given of them. Naegelé, on the mechanism of parturition, says, that "In every case, whether the nates have at first a completely transverse or oblique direction, they will be always found, on pressing lower into the superior aperture of the pelvis, to have taken an oblique position; and that ischium which is directed anteriorly, to stand lowest. In the most common position, where the sacrum of the child is towards the left acetabulum, as the breech descends into the pelvis, it is the left ischium that stands lowest, and is first touched by the finger. The child's left hip rotates forwards upon the right anterior inclined plane under the arch of the pubis, while the right hip slides backwards into the hollow of the sacrum along the left posterior inclined plane. As the shoulders are supposed to remain fixed in the uterus, flexion of the child's body takes place as it is being born, and restitution after the birth of the hips is effected. As the shoulders also engage obliquely, they undergo rotation, the left shoulder rotating on the right anterior inclined plane, and appearing under the pubis, while the right falls into the hollow of the sacrum (Fig. 26).

Fig. 26.



"But whilst the shoulders are descending in the above-mentioned oblique position, the head, with the chin resting upon the breast, presses into the superior strait in the direction of the right oblique diameter, that is, with the forehead at the right sacro-iliac junction, iput rotates upon the left anterior inclined plane, towards the and the forehead on the right posterior, into the hollow of rum, and the head is born in such a manner, that whilst the rests against the os pubis, the point of the chin, followed by t of the face, sweeps over the perineum, as the head turns on ral axis from below upwards (Fig. 27).

Fig. 27.



ıere is no essential difference in the mechanism of the labour, he sacrum is at the right acetabulum, except that the rotation rsed; the right hip and shoulder rotate on the left anterior in- plane, and the left hip and shoulder on the right posterior d plane; the occiput on the right anterior, and the forehead left posterior inclined plane. As before mentioned, when the is to the pubes, as it descends it becomes oblique, and then chanism is precisely the same as above described. (Figs. 26, ribe these.)

in positions of the cranium, the swelling of the integuments ly met with on that parietal bone which, during the passage head, is situated lowest, and on that spot with which it enters ternal passage, so in this case, the livid-coloured swelling on that part which, directed forwards, was situated lowest the passage of. the nates, and with which the nates were

he second chief position, viz.: with the anterior surface of ld corresponding to the anterior abdominal parietes of the , or in other words, with the sacrum of the child to the sacrum nother, the same effect is produced by the expulsive action as before. The breech descends to the outlet of the pelvis; a slight turn is effected; one of the ilia (and it is generally the left) appears under the arch of the pelvis, the other traverses the perineum; the breech and legs escape, the shoulders pass the brim, and descend until they press upon the structures at the outlet; one escapes under the arch of the pubes, the other follows the curve of the sacrum, and the head is propelled into the cavity of the pelvis, with the face looking to one side, and the occiput to the other.

It might be supposed, from the position of the head at the commencement of labour, with the face looking forwards, that the *occiput* would fall into the hollow of the sacrum, and the *face* emerge under the pubes; but this is not the case; for when the shoulders are born, and the head is in the pelvis, the face is directed to one side or the other, exactly as in the sacro-anterior position; and a precisely similar turn is effected, the face falling into the hollow of the sacrum; so that the fœtus in its exit makes a semicircular rotation, the face being placed forwards at the commencement of labour, and being expelled through the outlet over the sacrum and perineum. Dr. Ramsbotham, from whom the above description is taken, says farther, "I believe that in no instance, if the case were left entirely to nature—provided the child and pelvis were of the common size and form—would the face be expelled under the arch of the pubis." Dr. Collins also confirms it. Dr. Naegelé mentions this last as a deviation from the ordinary mechanism of breech cases. He also describes another deviation, in which the chin departs from the breast, and the head enters the pelvis, after the birth of the body, with the occiput pressed against the nape of the neck, and the vertex corresponding to one or other ilium of the mother. As the head presses lower into the cavity, the vertex turns gradually more and more backwards, so that when the trunk is born, the arch of the cranium is directed to the hollow of the sacrum, and the inferior surface of the lower jaw to the symphysis pubis. In the birth of the head, whilst the under jaw presses with its inferior surface against the os pubis, the point of the occiput, with the vertex, followed by the forehead, sweeps *first* over the perineum; thus bringing the occipito-mental diameter into apposition with the antero-posterior of the outlet.

The *diagnosis* of breech presentations has already been given; it is not usually difficult. It may be confounded with the face, particularly where the labour has continued for some time, and the presenting part is tumid. It will be distinguished from the latter by the absence of the bridge of the nose, by the moveable, *single* point of the coccyx, by the contractility of the sphincter ani, by the tubera ischii, by the cleft between the nates, by its roundness and softness, and by the organs of generation. Of these, however, the point of the coccyx and the sacrum are the best, as the others

ə so altered by swelling as not to be recognisable. The
ɩe of the meconium is not a certain sign, since it is occasion-
ɩt with in cephalic presentation, where the child is subjected
ɪg pressure, though in the latter case, Dr. Collins says it is
uid, from being mixed with the discharges from the uterus
gina.

*shape of the bag of waters*, is another diagnostic sign, being
ɪmispherical and more cylindrical than in vertex presenta-
ɪnd more resembling an intestine in shape.

*:ultation*, though not a certain test, is a corroborative proof;
ɪnd of the fœtal heart will be heard higher in the abdominal
if the head be at the fundus uteri, than if it be seated in its
atural position. The same is true of the *movements* of the
they being generally felt *lower* in the abdomen in breech
;han in those in which the vertex presents.

entations of the breech, although perfectly natural labours,
ɪerally more tedious for the mother, and more dangerous for
ld than those of the head, for reasons already stated, viz.;
ɪen, in pelvic labours, the head enters the pelvis, if every-
ɩe not favourable for its passing rapidly through it, the cord
ng compressed that the child is almost certainly lost.

*ıtment.*—Much more care and attention are required in the
ɜnt of these labours, than in those before described; not only
ect the soft parts of the mother, but also to preserve the
life, which is always placed in more or less danger. It is,
re, of great importance that a correct diagnosis should be
ɩarly. Being satisfied that it is the breech which presents,
e requires no interference until the breech shall have been
d through the external parts, further than to guard the soft
f the mother, and carefully to support the perineum. Above
ıgs, the attendant should not draw down the feet, as the in-
nced are too apt to do, in the hope of facilitating the delivery
ing something to pull upon; this practice always diminishing
ɜ of the dilating part, and thus *prolonging* the labour. As
ech escapes, it should be supported and carried upwards in
s of the pelvis, allowing it perfect liberty to change its posi-
make such turns as the mechanism may require. Mechanical
ıce is rarely required in these cases, the child *adapting itself*
passages of the mother.

n the umbilicus appears at the external organs, the cord
be seized and gently drawn down and pushed to one side;
ll prevent its being torn and pressed upon.

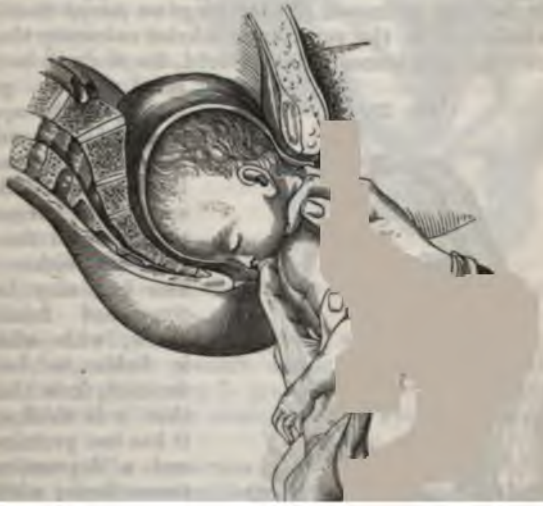
*strength* of the *pulsations* in *the cord*, is the *best evidence we*
the *necessity* for *any interference.*

n the thorax has emerged, if the arms have not escaped with
should be brought down by passing one or two fingers over

le the longest diameter of the head to become parallel with the of the vagina, and the patient urged to bear down.

the head be delayed while in the vagina there is danger of g the child; the extent of this danger will be estimated by the ation in the cord. As in most cases the head will be found with face in the hollow of the sacrum, the delivery may be hastened ntroducing one or two fingers of the left hand into the mouth, depressing the chin upon the breast, at the same time carrying ard the body of the child. (Fig. 28.)

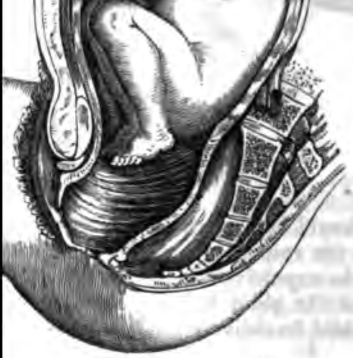
Fig. 28.



t should happen that the body is expelled with the face ante-
, and the chin should lodge upon the pubes, it should be car-
*ackwards*, and the chin drawn down by the finger introduced
he mouth. The remainder of the delivery and the after treat-
are the same as in vertex presentations.

*sentations of the inferior extremities.*—What has been said in
n to the danger of breech presentations, applies with even
force to those of the lower extremities. In this latter case the
may be compared to a *cone*, the apex of which presents itself
Of course, under these circumstances, the pressure upon the
is constantly increasing as it descends, and the external parts
ving been thoroughly dilated, when the body is born and the
ngages, it is much more liable to prove fatal to the child in
uence of the detention that almost unavoidably ensues; the
*osis*, therefore, in such cases is less favourable than in a *simple*
*presentation.*—*Diagnosis.* Presentations of the feet may be
y distinguished. Before the membranes have ruptured, the
waters often protrudes in a more cylindrical form, or like the
of a glove, and we discover that the presenting part is smaller
either the head or breech. At this stage we cannot readily dis-
sh whether it be the superior or inferior extremity that pre-
After the membranes have ruptured, the *foot* will be recognised by its greater length, by the rounded instep, by the uniform length of the toes, by the absence of a thumb, and by the presence of the heel with the ankle bone on either side. The *knee* may be distinguished from the elbow, with which it is liable to be confounded, from the fact, that it is thicker, that it has two prominences, and a depression between them; while the elbow, which is thinner, presents, between the two prominences, a projection, in which it seems to end. (Fig. 30.)

Fig. 29.

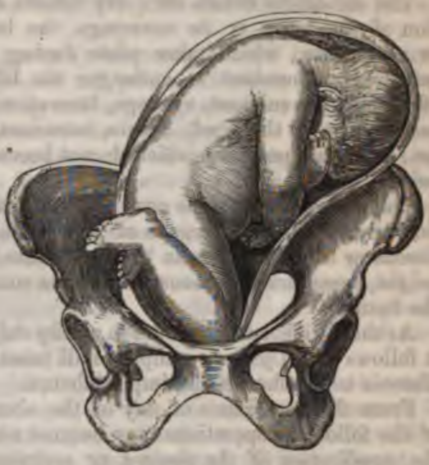


*Positions of the feet,* — Most accoucheurs enumerate *four* positions for footling presentations, viz.; 1st. Heels behind the left acetabulum, loins in front and to the left. 2d. Heels behind right acetabulum, loins forward and to the right. 3d. Heels behind the pubis, loins directly in front. 4th. Heels to the promontory of the sacrum. There are others who enumerate six, corresponding with vertex positions, and others again as many as eight, corresponding with those of the sacrum mentioned in the beginning of this article. (Fig. 29.)

Following the arrangement adopted in relation to breech presentations, we enumerate but *two*, viz: a *calcaneo-anterior*, and a *calcaneo-posterior*. 1st. When the heel is directed forwards and the toes backwards. 2d. When the heel is backwards and the toes forwards. The former is the more frequent, and both correspond to the two classes of breech presentations. (Fig. 30.)

The *positions of the knees*, have also the same varieties, the *anterior* parts of the leg corresponding to the sacrum and the vertex; and as they are commonly converted into footling cases, they do not require a separate description. (Fig. 30.)

Fig. 30.



*Mechanism.*—The feet meeting with no resistance to fix them, are liable to change their position during their descent until the hips enter the brim, which they do precisely as in breech cases; the mechanism, therefore, is the same, and does not require a further description.

*Treatment.*—The same rules apply to the treatment of presentations of the inferior extremities that were laid down in breech cases, with the additional caution, *not* to *yield* to the *temptation* to *pull down* the *feet;* the dilating part is already too small for safety, and if it be diminished by this procedure, the child will almost certainly be lost by pressure upon the cord during the descent of the head.

## PRETERNATURAL LABOUR.

*Preternatural labour*, or *dystocia*, signifies a faulty, or irregular the course of which is unfavourable, and in which the assis- f the obstetrician becomes necessary. It will be remembered is definition applies to all cases of labour, without reference to presentation or position, in which manual assistance be- necessary.

ording to Velpeau, the causes that render labour difficult, either upon the mother or the child. Some of them are seen, or do not occur till the moment of parturition; the title *idental* may be appropriated to them. Others exist before- and render the labour necessarily difficult; they merit the ination of *pre-existing* causes.

*accidental* causes are: any serious disease, such as inflamma- the brain or its coverings, the lungs, pleura, peritoneum, us, &c., which takes place during labour; any hemorrhage ntly abundant to endanger the life of the mother, or her ig; convulsions, syncope, laceration of the womb, the prema- scape of the cord, hernia, aneurism, asthma, great debility, d some positions which do not become bad until after the first

*pre-existing* causes are: deformities of the pelvis, malforma- disease of the organs of generation, calculus in the bladder, or other tumours in the excavation, deformities in respect to transverse positions, monstrous conformation and diseases of us.

hese different causes are in reality only complications of labour, ws that *Dystocia* comprises all cases of complicated labour, as a comprehends all simple labours.

n the occurrence of any of the above-mentioned causes, one following operations may become necessary, to wit: *turning*, *plication of the forceps*, or *craniotomy*. The first of these equently becomes necessary in cases of transverse positions child, as in presentations of the shoulders. As the mode of ling is the same whenever the operation becomes necessary, be described only in cases of *shoulder presentations*.

### PRESENTATIONS OF THE SUPERIOR EXTREMITIES.

lmost all cases of this kind it is the shoulder which presents t the superior strait, but it may happen that instead of a r, a hand or elbow may be prolapsed; still, when they are ed to a certain degree, it is the shoulder which fills the strait sents the obstruction. The descent of the arm or hand add ; to the difficulty; indeed it is rather serviceable, since it us in our diagnosis, and does not at all interfere with the ful termination of the labour. In this respect it differs from presentations, in which the descent of the feet is altogether voided.

In all cases of shoulder presentation the back of the child either looks forwards towards the abdomen of the mother, or backwards towards the spine; the former is twice as frequent as the latter.

It need hardly be said, that in the majority of such cases, the delivery is impracticable except by art, although there are cases reported of what is called *spontaneous evolution*, in which the child has *righted* itself, the arm and shoulders receding, and the breech descending in its place, the labour being completed by the unassisted efforts of the mother.

Although spontaneous evolution *may* take place, it is more conformable to the dictates of prudence and humanity to turn the child, and bring down the feet, or restore the head to its proper place.

*Causes.*—There have generally been enumerated but two great presentations, viz., the *cephalic* and *pelvic*, all others are but deviations from these. As footling and knee presentations are deviations from the breech, so are those of the shoulder from cephalic. Various causes have been enumerated; among them are particular positions of the mother's body, inclination of the womb or of the straits of the pelvis, sudden and irregular movements of the fœtus, irregular early contractions of the womb, and irregular distension. Dr. Rigby concludes that the causes of arm or shoulder presentations are of two kinds, viz., when the uterus has been distended by an unusual quantity of liquor amnii, or when, from a faulty condition of the early pains of labour, its form has been altered, and with it the position of the child.

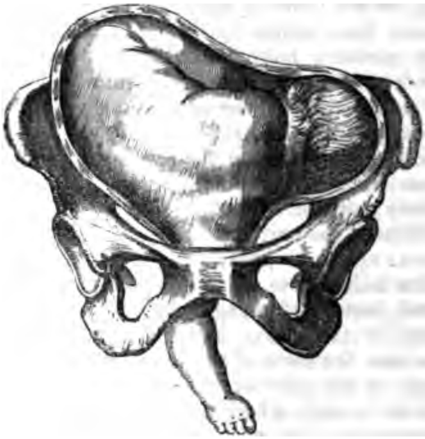
Dr. Meigs looks upon obliquity of the womb as the great cause. When the fundus falls over to either side, the action of the uterus is oblique, the head, instead of engaging in the superior strait, strikes against the brim of the pelvis, and glancing off from thence, is turned upwards into the costa of the ilium, while the shoulder descends or engages in the superior strait.

*Diagnosis.*—It is only when the labour has commenced, and indeed made some progress, that a shoulder presentation can be positively detected. It may be *suspected*, if we are unable to reach the presenting part, if the os uteri, though flaccid, opens slowly, if the bag of waters is cylindrical, or like the finger of a glove, and if the uterus ceases to act after the membranes have been ruptured for some time. We can only *positively* detect the presentation by distinguishing the different parts of the child, as, for instance, the spinous process of the scapula, the clavicle, the round-shaped shoulder, the axilla, the ribs, the arm, and in some cases the hand when prolapsed, distinguished from the foot by the means already pointed out. The aspect of the palm of the hand will mark whether it be the right or left. The diagnosis between the *breech* and the *er* will be easy, if the distinguishing marks of the former are bered.

*tions.*—There are two positions for the presentation of each er, viz., a *first* and *second* for the *right shoulder;* and a *first ond* for the *left.* In *both* the first positions the head is on the the mother, and in both the second, on the right. As er presentations are deviations from *vertex* presentations, the sitions are the most common. These positions are called the *ubic* and *dorso-sacral* of the right, and *dorso-sacral* and *ubic* of the left shoulder.

*ht Shoulder.*—*First position, right dorso-pubic.*—The head of ld is to the *left* of the mother, the *back* of the child is towards *nt* of the mother (dorso-pubic), and the *face* of the child with s and feet look towards her back. (Fig. 31.)

Fig. 81.



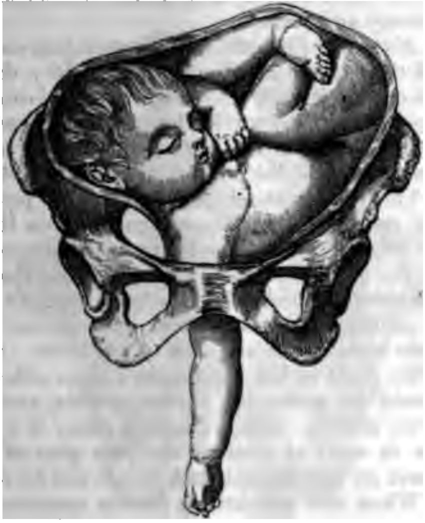
*nd position, right dorso-sacral.*—The head of the child is to *ht* of the mother, the *back* of the child towards the *back* of other (dorso-sacral), and the *face* and *front* of the child look ls the front of the mother. (Fig. 32.)

*t shoulder, left dorso-sacral, First position.*—The head is *left*, the *face* and *front* of the child look forwards, and the s to the back of the mother (dorso-sacral of the left).

*nd position, left dorso-pubic.*—The head is to the *right*, the d *front* of the child look backwards, and the *back* is towards nt of the mother (dorso-pubic of the left).

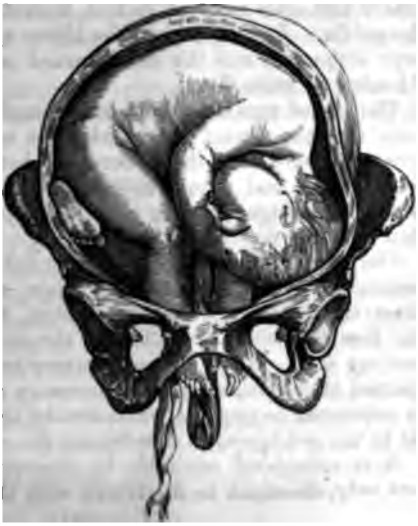
*atment.*—Having ascertained that the case is a *shoulder preon*, the indications are to deliver by the operation of *turning, ion;* by which is understood "the act of turning the child with the hand, and bringing one of the extremities of its great diameter to the superior strait." (Velpeau.)

Fig. 32.



There are three varieties of this operation described by obstetrical writers: *First, Version by the head,* in which the presenting part is pushed away, and the head substituted for it; the remainder of the labour being left to nature. *Second, Version by the breech.*—Where the pelvic extremity of the child is substituted for the presenting part, and the case converted into a *breech labour. Third, Version by the feet,* in which the hand is introduced into the cavity of the uterus, one or both feet seized and brought down, causing the child to make a complete evolution, and extracting it footling. (Fig. 33.)

Fig. 33.



The first and second methods, although safest for the child, are rarely employed, in consequence of the difficulty of seizing and moving the parts mentioned into a more favourable condition. The third is the mode of practice generally adopted, and although more dangerous to the child, it is safer for the mother, gives the attendant more complete control of the case. It is de of delivery now almost universally adopted, both in this y and Europe.

*od of Procedure.*—The operation ought never to be attempted os uteri is *dilated*, or *dilatable;* the fittest moment is when teri is *fully dilated* and the *membranes unruptured*. If the os rigid and unyielding, the proper means of relaxing it should adopted; the rectum and bladder should also be thoroughly ted, and the *position* carefully ascertained.

patient should be placed in the position most convenient to erator; some recommend that on the back, with the hips on ge of the bed, and the knees supported by assistants; some hands and knees; others prefer the ordinary position on the c. The *choice of the hand* depends on the position: the rule *that hand whose palm, when opened in the cavity of the womb, owards the abdomen of the child.* Some recommend the use right or left hand, according as either is most convenient. It be well oiled on the outside, and introduced in a conical nto the vagina, during a pain; it will then be ready to enter uteri as soon as the pain goes off. The presenting arm is an impediment, and should not be removed.

en the membranes remain unruptured, the hand should be insinuated between them and the uterus, until the feet (or t) are found, always stopping and opening the hand on the on of a pain.

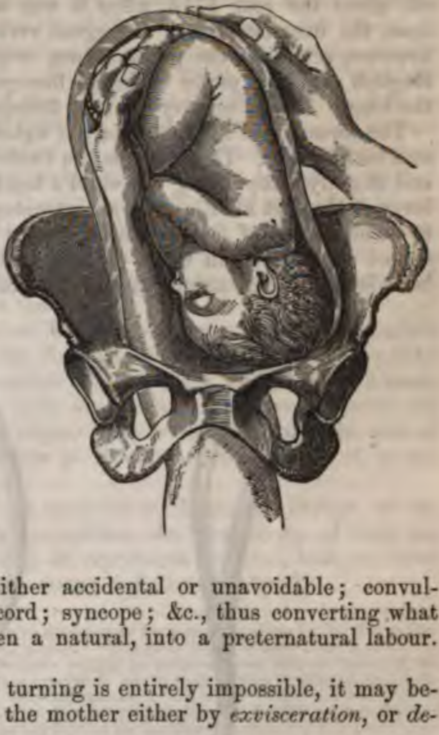
ertain that it is a foot that is seized. *Now* rupture the mem- and draw the feet, or foot, with a waving motion, slowly into lvis. By this method the liquor amnii is retained, the uterus listended, and the child turned with as great facility as in a et of water."

act of turning should be accomplished during an *interval* of hus the danger of rupturing the womb will be avoided. Ex- pressure with the unoccupied hand favours the version very erably, and should never be neglected. In turning, the feet be brought over the *front* of the child, and not over the back, voiding dislocation of the spine.

*extraction* should be accomplished *during* a pain, always bering the axis of the pelvis, and being careful not to the fœtus in a wrong position, but endeavouring to make ce fall into the hollow of the sacrum. The case is now a g one. When the membranes are ruptured, and the waters d off, additional care is necessary not to *force* the uterus, but eavour to promote relaxation by the proper means, and above use gentleness in overcoming the contractions.

s considered advisable by some practitioners to turn by *one* ly, inasmuch as the breech with the thigh turned up, is more

Fig. 34.



bulky than the hips with the thigh extended; the passage will be better prepared to admit the quick transit of the child's head, upon which the safety of the infant depends. After the case has been converted into a footling, it should be treated as though it were so originally, that is, left as far as possible to the natural expulsive powers.

*Version in cephalic presentations*, is accomplished by the same method of proceeding: the same rules applying for the choice of the hand, &c., as in shoulder presentations. This operation sometimes becomes necessary in hemorrhages before delivery, either accidental or unavoidable; convulsions; prolapsus of the cord; syncope; &c., thus converting what would otherwise have been a natural, into a preternatural labour. (Fig. 34.)

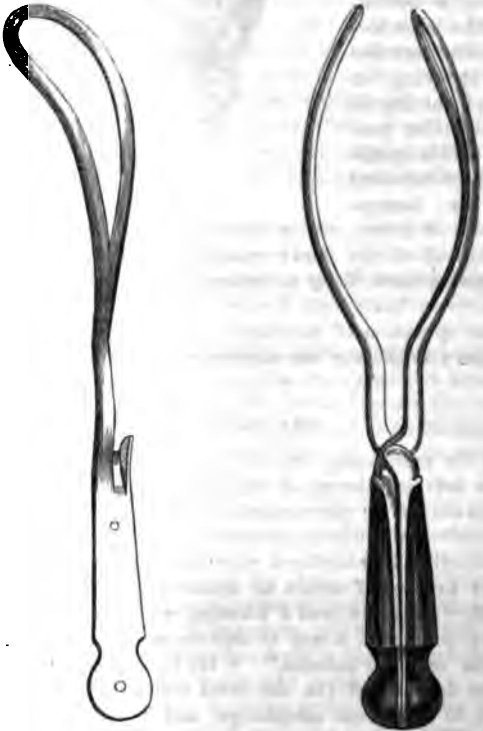
When the operation of turning is entirely impossible, it may become necessary to deliver the mother either by *exvisceration*, or *decapitation*.

## THE FORCEPS.

It would be manifestly out of place, in a work of this kind, to enter into a detailed history of the forceps. Suffice it to say, that although hinted at by the ancients, we find no record of their discovery or application, till the beginning of the seventeenth century, when Dr. Hugh Chamberlayne published a translation of Mauriceau, in the preface of which he declares that his father, brother, and himself, "have, by God's blessing and our industry, attained to, and long practised, a way to deliver women without any prejudice to them or their infants." "By this manual operation, a labour may be despatched (in the least difficulty), with fewer pains, and sooner, to the great advantage, and without danger, both of woman and child."

merit of the discovery, therefore, seems to rest with Dr. Paul erlayne, by whom and his sons it was kept a profound secret, out the year 1715, when it was made public. Since that he instrument has undergone various modifications, always, r, retaining the general form originally given to it. The h generally prefer the short forceps, the French and German g. In this country the long forceps are most generally used. forceps are intended for the extraction of the child's head, *thing else.* They possess the twofold power of, 1st, grasping ghtly compressing the child's head; 2d, that of acting as a f the first kind, and as an extractor. They are to be applied ther part of the child's body than the head, and are not de- to be used in cases of premature delivery, or where the larger than natural from abnormal growth.

Fig. 85.



instrument consists of two branches or pieces, one intended
sed by the right hand, and the other by the left. The first
d the *right hand* blade; the second, the *left hand* blade, or
. Each branch consists of three parts, viz.: the blade, or
he lock, and the handle; in some instruments the handle
ates in a blunt hook. The clam or blade, ought, if possible,
pplied to the side of the child's head, and not to the face or
and should extend from the vertex to the chin. It is pro-
rith an open space called the *fenestra*, which not only renders
trument lighter, but enables it to be more accurately applied
sides of the head. The *lock* consists either in a *pivot* in one
, which is called the male blade, and a notch in the other,
thence the female blade, which is the German lock; or a
n the upper surface of the left, and in the lower surface of
ht branch, which is the English lock.

original forceps (and at this day, many of the English
) were *straight* in the direction of their length; that is, they
ly one curve, that which applied itself to the child's head.
nellic and Levret, both about the same time, gave to the
a new curve on the edges, so as to adapt them to the axis of
vis. This modification is therefore often spoken of as the
*curve.*" (Fig. 35.)

"*eclectic forceps*," as modified by Professor Hodge, of the
sity of Pennsylvania, combines the advantages of both the
ıd short forceps. Fig. 36 represents them: *a*, lock; *b*, blunt
t end of handle; *c*, *d*, clam; *e*, *f*, the fenestræ.*

---

ollowing description of this modification of the forceps, is given by Dr. Hodge him-
communication to Professor Huston: "The great object of the forceps is to extract
of the fœtus from the mother's organs, in suitable cases, without injury to the
child. It is notorious that injuries to one or both parties frequently result, ex-
o well-founded dread of this instrument in the minds of females, and even of
s. Many causes contribute to this unfortunate result. No doubt much depends
e, weight, and especially on the form of the instrument employed, a fact confirmed
nost innumerable varieties which have been suggested. The instrument, as hereto-
, is evidently imperfect; and the one now suggested, is presented under the im-
hat, while it maintains all the excellencies of the former varieties, the injurious
are partly, if not wholly, avoided. It is a modification of the long French forceps,
be well termed an eclectic forceps, as combining, as much as possible, the peculiar
ies of the English, German, and French varieties.
dvantages of the French or long forceps are, I think, many and decided, as 1st, by
operation pertaining to this instrument, can be performed. There is no necessity
e form, structure, or size, of the instrument, whatever may be the presentation of
its position, or its location. 2d. By them, sufficient power can be applied in cases
ty, which cannot be done by the short forceps. Their leverage is greater. 3d. The
s of the blades, which, without detracting from the utility of the instrument, will
heir application to the sides of the head, even in oblique and transverse positions.
the modern English forceps, are too broad to allow the proper manipulation of the
at in the cavity of the pelvis. They cannot be introduced through the vulva with-
especially in first labours. The French forceps can very generally be applied with-

t may be added as another advantage, that as habit in the use of an instrument is
tant, the practitioner will sooner become accustomed to a forceps which he can
ı all occasions, than when he is obliged to vary it continually; especially when it
bered that among the strong and well-formed females of America, cases for the
e not very numerous in the circle of any practitioner.

*cations for their Use.*—The forceps are indicated, 1st, where
is unable to expel the child, either from a want of sufficient
or when the labour is arrested by certain malpositions of the

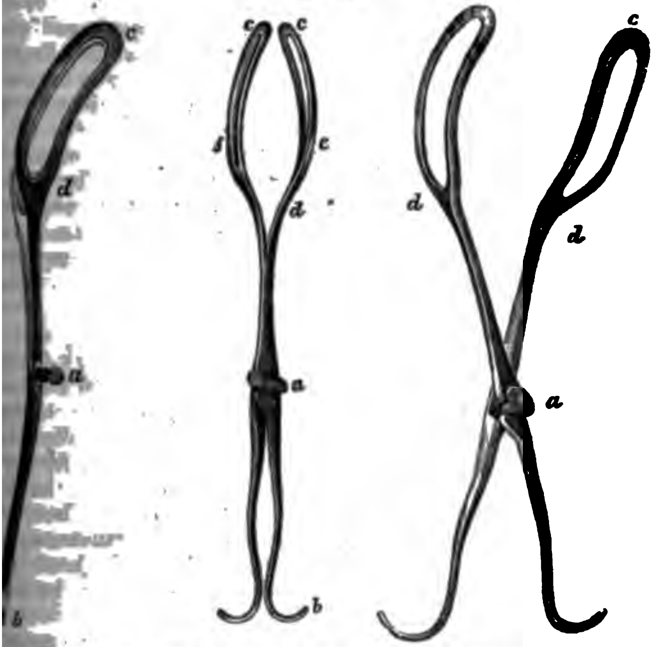
isadvantages, which experience has taught me to arise from the French forceps,

ts unnecessary weight.
he pelvic curve, in the variety most in use in this country, is not sufficiently great.
ıen the head is high in the pelvis, the perineum will be too much pressed upon, or
ılades will be applied in the direction of the occipito-frontal or longitudinal dia-
stead of the occipito-mental or oblique diameter.
ıe divergence of the blades commencing at the joint must necessarily distend the
pecially its posterior margin) prematurely, and when the head is high up, gives
endangers the laceration of the perineum.
The small size and kite-like shape of the fenestra prevent any portion of the
even of the parietal protuberances, projecting into their openings: hence the hold
ad is less firm, and space is occupied by the blades, the thickness of which is added
ansverse diameter of the head.
The flatness of the internal or cephalic surfaces of the blades—so that the margin of
tra, often measuring three-eighths of an inch, is much thicker than the external
he blade—increases the space occupied by the instrument. Hence in cases of
, where compression is employed, contusion or even wounding of the scalp results.
The mode of junction of the French forceps is decidedly inconvenient when com-
h the English, and especially with the German mode.
disadvantages I have endeavoured to obviate without diminishing or circum-
he utility of this most valuable instrument, to which the profession and the public
ıch indebted. My experience encourages the hope, that the attempt has been in a
t degree successful, so that even in inexperienced hands, the dangers of the forceps
n materially lessened.
e weight of the instrument has been diminished from twenty ounces, avoirdupois,
een ounces.
e pelvic curve has been slightly increased, so that the perineum may not be dan-
pressed upon when the blades are in the axis of the superior strait. To counteract
of power which may ensue from the increased curvature, there is an angular bend
ndles, in an opposite direction, that the direct line of traction may be preserved, a
n of our skilful and experienced instrument-maker, Mr. Rorer.
e shanks or commencement of the blades are nearly parallel, diverging no more
ıbsolutely necessary, until they approximate the head of the child, when a more
vature, than in the Levret forceps, occurs.
e proper blades of the instrument, from the shanks to the extremities, are nearly of
breadth throughout, being equal to that of the extremity of the French forceps.
e advantages are a more secure hold of the head, and especially allowing larger
so that the parietal protuberances may project into the openings, and no space
ed by the blades, when properly applied.
e cephalic surface of the blade is concave, so as to be adapted to the convexity of
as suggested by Dr. Davis in his improved forceps, hence no edges touch the scalp,
ı is no wounding of the tissues, even when great compression is made.
e very ingenious and scientific mode of locking the blades, as in the German or
forceps, by means of a conical pivot, and the corresponding oblique conical opening
eption, is adopted, by which all the facilities of the English junction are enjoyed,
ecurity and firmness of the French joint are maintained.
clectic forceps weighs one pound and one ounce, being nine ounces lighter than
h forceps, as usually manufactured by Rorer, of this city, and eleven ounces lighter
ecimen of Dubois forceps in my possession, made in Paris.
whole length of the instrument (see Fig. 36), in a direct line from *b* to *c*, is 16
rom the joint *a* to the extremity *b*, the length of the handles is 6·8; from *a* to *d*,
parallel shanks is 3·5; from *d* to *c*, the proper blades in a direct line, is 6 inches;
the extremities, to *e f*, the greatest breadth, 3·7 inches.
eparation between the points *c c*, when the handles are in contact, is ·5 of an inch;
*f*, the greatest breadth when the handles touch, is 2·5; when the separation at *e f*
points *c c* are separated to 2 inches; the breadth of the blade is 1·8, slightly taper-
near *c c*, the extremities. The breadth of the fenestra is 1·1; the thickness of the
2 of an inch. The perpendicular elevation of the points *c c*, when the instrument
rizontal surface, is 3·4 inches, which indicates the degree of curvature of the blade.
levation of the handles near the joint, above the same horizontal line, is 1·3 (in-
he thickness of the blades), which indicates the extent of the angular bend in the

ul perusal of these judicious remarks of Professor Hodge, will impress the student
advantages of the eclectic forceps, and will render any farther description of this
nt unnecessary.

d at the brim, or in the cavity of the pelvis; 2d, whenever the our becomes dangerous for mother or child, and where the danger only be removed by hastening the labour.

Fig. 36.



t is meant, when the *forceps* are used, to supply with them the ufficiency, or want, of labour-pains; but, so long as the pains tinue, there is reason to hope they will produce their effect, and refore justify waiting.

*The first stage of labour must be completed*, that is, the os uteri st be dilated, and the membranes broken, before the attempt is de to apply the forceps. They are never to be used as *dilators*. e must be taken, however, that, from an aversion to the employnt of instruments, their use is not too long delayed, and thus the efit to be derived from their application be entirely lost.

ost favourable case for their application is, where the head inferior strait; the nearer the head is to the external organs, readily may the instrument be adjusted to it, especially if taken place. It is very rarely, if ever, necessary to the head has not yet passed the superior strait.

rceps should always, *if possible*, be applied over the ears of ld; it is a good rule, therefore, always to find this part, be- oceeding to apply them.

*iod of Application.*—Having determined to apply the forceps, ne general rules should be observed as in turning, viz.: eva- he bladder and rectum; draw the patient to the edge, or side bed, having previously protected it from injury, and place her on her back with the feet supported, or as the English ioners prefer, on her left side. The necessity and nature of eration should always be explained to the patient or her , before proceeding to its performance.

instruments should always be warmed and well anointed be- sing them, and some mild unguent should also be applied external organs, and the patient protected from exposure, heet or blanket thrown over her. The great importance of a knowledge of the *position of the head* should be impressed he mind of the practitioner, before commencing this opera-

*ich blade must be introduced first?*—In this country and on ntinent, where the long curved forceps are used, very explicit ons are laid down for the choice of the blade. In England, the short straight forceps are employed, it seems to be a of indifference which is applied first, the general directions to apply that blade first, the lock of which looks forwards. llowing directions, therefore, apply to the use of the *long forceps.* Let the student remember, in the first place, that ceps are to be applied perpendicularly to the transverse, and l with the occipito-mental diameter of the child's head. As ral rule, the *left hand*, or *male blade*, should always be intro- *first.*

*ipito-anterior position*, where the vertex presents and rotation ken place. The left hand, or male blade, is to be taken in the nd as a writing pen is held, two or three fingers of the right re to be introduced between the left side of the vagina and ild's head, so that their extremities may touch the os uteri; ndle of the instrument is first raised up high in front of man's right groin, so as to bring the other extremity in the the axis of the vulva, into which it is next gently and slowly uced *in the interval between the pains;* in proportion as it the handle is by degrees brought from above downwards, m right to left, towards the median line. The point of the nent must be kept carefully in contact with the child's head, *force* used in the introduction. It is thus moved onwards, g it follow the left posterior inclined plane, gradually depress- e handle until the instrument has been placed by the side of ild's head in the direction of the occipito-mental diameter.

The handle is then to be given in charge of an assistant, and the *right hand*, or *female blade*, to be taken in the right hand in the same manner as before, while the fingers of the left are to be introduced between the right side of the vagina and the child's head. Upon these, as the guide, the blade is to be introduced as before described, gradually depressing the handle till it comes in contact with and crosses the blade first introduced; the two are then to be locked, and the adjustment is completed. Care should be taken that nothing be entangled in the lock of the forceps, by carrying the finger round it.

Should the handles of the forceps, when applied, come close together, probably the bulk of the head is not included between them, and therefore, when we acted with them, they would slip.

If the handles, when locked, are at a great distance from each other, they are not accurately applied, and will probably slip. Allowance should be made, however, in these estimates, for the different dimensions of the heads of children. When the instrument is thus adjusted, a slight compression, and traction should be made in order to be sure the soft parts of the mother are not included in the grasp (which is known by her complaints), and also to bring the instrument to its proper adjustment on the child's head.

As soon as a pain comes on, begin the extraction by slowly moving the forceps from handle to handle, thus causing them to act as double levers, exerting at the same time sufficient extractive force to prevent the opposite blade from slipping deeper into the organs, while the handles are moved to the right, or to the left.

Great care should be taken to support the perineum as the vertex emerges, and at the same time to carry the handles of the forceps upwards, towards the abdomen of the mother, causing the head to execute the same movements, as though it were expelled by the natural pains.

The woman should be allowed intervals of rest between the extractive efforts, precisely as in a natural labour, unless there be some pressing exigency for her rapid delivery; at the same time the hold upon the forceps should be relaxed, so as to remove the pressure from the head.

When the head is born, the forceps should be removed, and the labour completed by the natural powers of the woman.

In the operation just described, that is, after rotation has taken place, when the forceps are adjusted, the lock looks upwards, and the concavity of the new curve is directed towards the symphysis pubis, while the convexity coincides with the hollow of the sacrum. In every application of this instrument, the general rule is that the *concave edges should look towards the pubes, and the convex towards the hollow of the sacrum.*

e *first position, before the rotation has taken place,* the same
rules are to be observed in the introduction. When the
re locked they are inclined towards the left thigh, and the
ks upwards and to the left. The same rule of traction is to
rved as before; the rotation will take place as the head
s.

e *second position,* the adjustment is not so easy, because after
oduction of the first blade, it occupies so much of the ante-
nmissure of the vulva as to leave insufficient space for the
tion of the second. To obviate this, after the first, or male
introduced, retract it a little till it is opposite the left
, then give it in charge of an assistant, and introduce the
blade to its proper position; now pass the male blade up to
ion under the ramus of the left pubis, and lock as before;
dles will point towards the right thigh, and the lock will
wards and to the right. Make traction as before.

*occipito posterior* positions, the forceps ought to be intro-
nd fixed as in the former positions, only the handles must
more depressed, and the perineum thrust back, so as to
em to adapt themselves to the occipito-mental diameter.
ation has taken place into the hollow of the sacrum, as the
nust escape first, the first movement in extraction should be
the handles up a little, so as to increase *flexion;* then as
ex escapes over the perineum (which is greatly distended
peration, and should be carefully guarded), they should be
*d,* so that the head may extend itself backwards, as it always
these labours. The rest of the process is completed as in
labour.

e *fourth* and *fifth* positions, where rotation has not taken
ne application is more difficult; the blades rather seize the
its vertical diameter, and are brought into parallelism with
ique as the extraction proceeds. The introduction must
ce as in a first or second position, the fifth corresponding to
, and the fourth to the second. In these positions the forceps
be so placed, that the concave edge may look forwards, and
wable to rotate the vertex into the hollow of the sacrum,
all hope of bringing it to the pubes has failed.

is one position of the child's head in which it is recom-
to introduce the *right hand,* or *female blade* first, viz., the
*pito-iliac,* according to Velpeau, where the head is trans-
ne occiput at the left ilium, and forehead at the right; the
nd blade is to be introduced first, and conducted with care
of the right sacro-iliac junction, as high up as the forehead;
the assistance of the fingers of the left hand, placed under
ex edge, and in concert with the right hand, move it from
orwards, and from right to left, until its concave edge is

turned towards the left iliac fossa, and the blade has arrived upon the right parietal protuberance. The handle, strongly depressed, is then given to an assistant, who holds it against the woman's left thigh.

The left branch is held in the left hand, and passed up along the posterior part of the pelvis, until its point is above the superior strait, and the pivot even with the mortice that is in the other branch. After having joined them, and dislodged the head, if it be still in the superior strait, and forced the occiput to descend into the excavation, provided it were not already there, the concave edges of the instrument are gradually brought to the front, and the remainder of the operation is conducted as in the occipito-pubic positions.

Dr. Meigs describes a similar operation, when the head is transverse, but lower in the pelvis, with the vertex resting on the left ischium, and the forehead on the right.

"When the instrument has grasped the head in this position the handles will project very much towards the left thigh in abduction; but if we introduce the male blade first, inasmuch as its handle will project towards the left thigh, it will occupy all the space on that side, and prevent the insertion of the second branch, for there is no place in which to depress the handle. To avoid this difficulty, take the female blade in the right hand, and introduce it into the posterior and right side of the vagina, causing its point to sweep over the face to the right side of the head, behind the pubis, leaving the handle to project towards the left thigh. Next take the male blade into the right hand, and turning the concave edge of the new curve downwards, insert the point into the right side of the vagina below the female branch. Let the fœtal face of the clam apply itself to the convexity of the head, and slide it onwards, and in proportion as it enters, make it sweep round the crown of the head towards the back of the pelvis. In effecting this, the handle comes gradually down as the clam gets on the left side of the cranium, and at last the lock is found where it ought to be, viz., under the upper or female blade, with which it is then locked."

Having ascertained that the head is properly grasped, the attempt may be made to rotate it, and the latter stage of the operation will be the same as already described.

*Right occipito-iliac position.*—The only difference between this and the left occipito-iliac position is in the application of the forceps, in doing which the left blade is applied first.

The forceps are sometimes necessary in *face presentations*. In these cases they may be applied to the sides of the head, as in the preceding. In those examples in which the chin comes to the pubis, the method of application is the same as when the vertex is at this point; but in those in which the forehead is at the pubis, the handles must be very much depressed at first, as well as in the o-posterior positions; as the case proceeds they must be ly elevated, so as to draw the chin down to the fourchette, hich it must slip. As soon as the chin is free the handles e allowed to descend again, whilst the traction is continued he head is born.

ases of *locked* or *impacted head*, instead of applying the for- the sides of the head, one blade is passed over the face, and her over the vertex, for this reason: it generally happens the head is thus locked, it is in its transverse, or bi-parietal er, one parietal protuberance being held at the pubis, and the at the projection of the sacrum; there is not space enough, ore, at these points to admit the blades, and if they are to be l to the head, it can only be on those parts that are free from pressure, as the face on one side, and the occiput on the other. applying the forceps in these cases, they should be well pressed er, to prevent their slipping when the traction effort is made. otion from handle to handle, assisted by the traction, will lly be sufficient to disengage the head, after which the forceps l be removed.

tly, in pelvic presentations, when the trunk is delivered, and ad detained, the method of proceeding is as follows: if the in the hollow of the sacrum, the body, wrapped in a napkin, be raised upwards, and held in a position nearly perpendi- then the left branch is introduced and applied to the head, he chin to the vertex, afterwards the right is adjusted, follow- e same rules as when the heads descends first.

however, the *occiput* is in the hollow of the sacrum, and it can- turned to the front of the pelvis by manual assistance, the hould be carried back over the perineum as far as can be with safety to its neck, and the forceps introduced in front of ly, as before. In extracting the head, we should endeavour with such force as to cause the chin and forehead to emerge the arch of the pubis.

ll cases the trunk is to be turned towards the direction in the occiput looks, and the forceps introduced along the sides head, in such a way that the concavity of its edges may be s the front, or brought there in the progress of the operation. er whatever circumstances the forceps are applied, the extrac- ould always be performed in the line of the axes, and always *ntleness.*

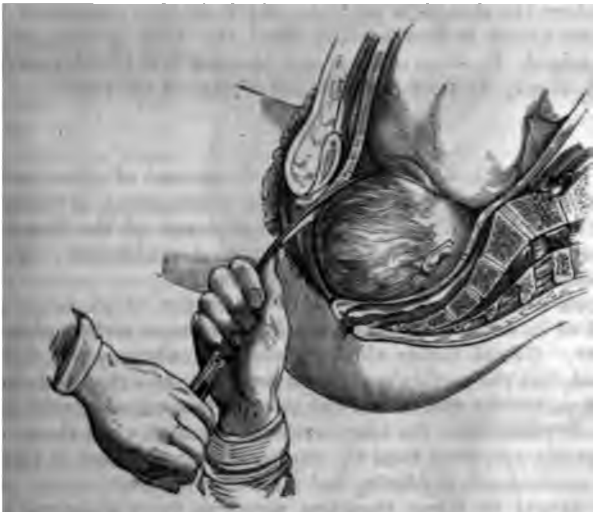
### THE VECTIS, OR LEVER.

st idea of this instrument will be had, by considering it as dle of the *forceps*, a little lengthened and enlarged, with the placed in a direct line with the blade, that is, without any curvature.

her.

n the second method, it is evident that if there be sufficient room
he pelvis for the introduction of the fingers of the left hand, there
be but little necessity for instrumental assistance.

Fig. 87.



n the third method, that proposed by Dease, of Dublin, the in-
ment is introduced as a single blade of the forceps would be, the
at is carried fully over the child's head, and the handle grasped

i is to be made during a pain. This instrument may be used ect malpositions, and to assist rotation and flexion.

## THE FILLET OR NOOSE, AND BLUNT HOOK.

first consists of a strip of strong cloth, silk, or leather, formed unning noose, and intended to be introduced over the head tever way can be most easily accomplished; and this done, p is tightened, and extraction effected by main force. Its now discarded in head presentations. Some persons, how- ill make use of it to effect extractive force upon the ham, r axilla; but, as the *blunt hook* answers a better purpose, more easily applied, it is now rarely used, except to confine d in shoulder presentations, where turning is necessary.

*blunt hook* is applied to the groin in breech cases, or to the vhere the shoulders are delayed; it is also sometimes used uce flexion in breech cases, when the body is born and the tained. In these cases it may be tried first in the mouth; if l, it may be fixed upon the lower edge of the orbit.

## CRANIOTOMY.

operation is demanded at times on account of either mother l; on account of the mother, in consequence of deformed on account of the child, in consequence of the dispropor- size of the head, tumours of the chest or abdomen; or both onditions may occur at the same time.

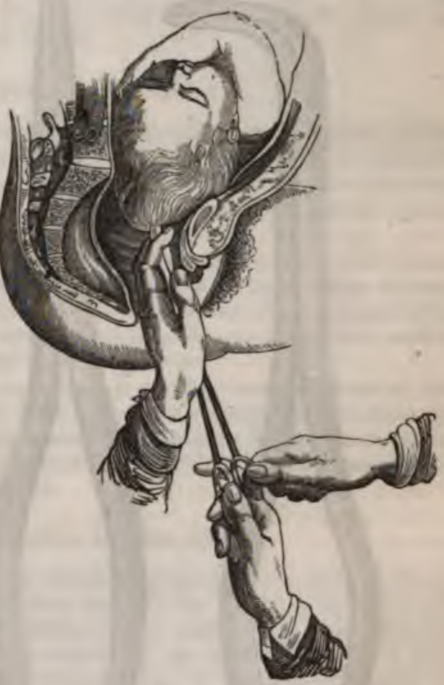
orm smallness of the pelvis, or contraction of its brim, or of t of its cavity or outlet, are, of course, most serious obstacles ur. Unless timely aid be given, not only may the child be ed, but the mother's vital powers may be exhausted, in in- l parturient efforts, and the most serious consequences result oft parts, from the long-continued pressure upon them, such ghing, apertures from the vagina into the bladder or rectum, er accidents, rendering her miserable for life.

should be taken, therefore, never to delay assistance until man has become exhausted. Shivering, or vomiting, dry tongue, and a pulse above 100, show a necessity for active ence.

*object of the operation of craniotomy* is to terminate the with safety to the mother in cases where, from the dispro- between the size of the fœtal head and the pelvis, a living n neither be expelled by the natural powers, nor extracted forceps; it being always understood that *the distortion is reat as to prevent the extraction of the child when mutilated.* rding to most authorities, whenever the bones of the pelvis h much nearer to each other than three inches in the antero-posterior diameter, it is unequal to the transmission of the skull entire; and unless there be at the superior strait an antero-posterior diameter of an inch and a half with a transverse of three, it would be useless to attempt to deliver *per vias naturales*, even after the head has been reduced in size.

In some cases, where the sutures are very loose, the evacuation of the brain is often sufficient, as the bones of the cranium collapse so much by the pressure of the womb that the child may be expelled by the natural powers. But it is presumed in this case, that the pains are strong and frequent. Should this not be the case, the brain must be evacuated, and extracting force applied.

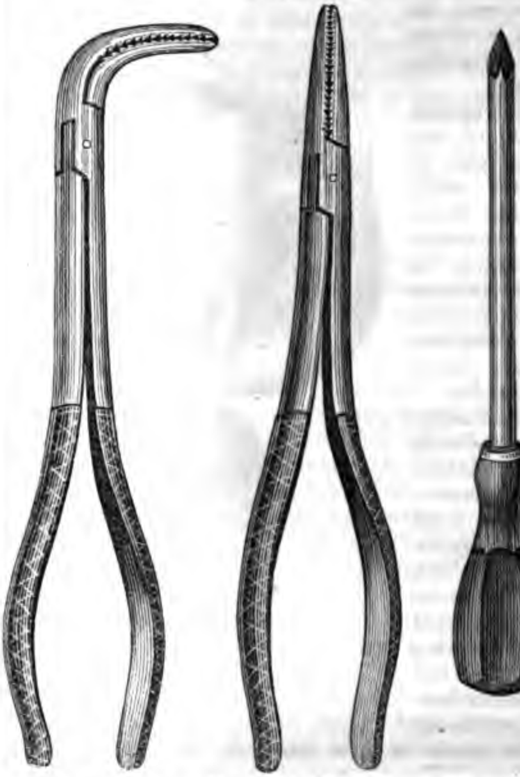
Fig. 38.



The instruments required are of two kinds,—the one to perforate the skull, and the other to extract, after the necessary diminution is effected. The first are called perforators, the second, crotchets, blunt hooks, craniotomy forceps, &c.

*Mode of operating.*—It is not absolutely necessary for the success of this operation, that the os uteri should be *entirely* dilated, although the wider the orifice is, the less danger will there be of injuring that organ. The rectum and bladder having been previously emptied, the woman is to be placed in the same position as in forceps operations. The perforator should then be carefully applied upon the groove between two fingers of the left hand, previously introduced, and placed upon the part of the head which it is proposed to open. It must now be passed forwards with a semi-rotatory n until it penetrates the bone; if the *scissors* are used, the handles l be separated as widely as possible. The cutting edges are o be placed at right angles to the first incision, and again ted, so as to make a crucial opening. The instrument should e passed into the skull, and the brain broken up, after which e instrument) should be withdrawn. (Fig. 38.) Then the et should be introduced in the same manner, and fixed upon side or outside of the head, and extraction practised, being areful to guard the soft parts of the mother.

Fig. 39.



he head cannot be delivered in this manner, recourse must be the craniotomy forceps, and the bones broken up and ex-d in pieces. Sometimes the forceps may be used advantagerously, where the crotchet cannot. There are a variety of instruments recommended in the performance of this operation: in the first stage, Smellie's scissors, and their modification by Holmes; an ordinary bistoury wrapped near to the point; the ordinary trocar; &c. In the second, the sharp crotchet; the blunt hook; the bone forceps of Dr. Davis; the cephalotribe of Baudelocque, jr.; the straight and curved forceps of Dr. Meigs, &c. (Fig. 39.)

*After treatment.*—The nervous shock will be best treated by quiet, small doses of opium, and moderate stimulation. The condition of the vagina and uterus should be carefully watched and occasionally injected with warm water. If symptoms of inflammation arise, they should be met promptly by venesection, leeching, calomel, and opium. In other respects, the patient should be treated as after a natural labour.

## CÆSAREAN OPERATION.

When from any cause the antero-posterior diameter of the superior strait, or the transverse diameter of the lower, is not more than 1½ inches, there is no possibility of delivery "per vias naturales," and it becomes necessary to resort to the Cæsarean operation.

The conclusions that have been derived by Dr. Churchill from a careful examination of statistics are, "that in cases where we cannot deliver the patient by any other means, and when, consequently, both mother and child would inevitably die, we may afford each a chance by performing the *Cæsarean section.*"

The best period for operating is at the commencement of the labour, provided there be no doubt as to the necessity. The strength of the woman is then unimpaired, she can bear the operation better, and runs less risk of inflammation. For the method of performing this operation, see *text-books.*

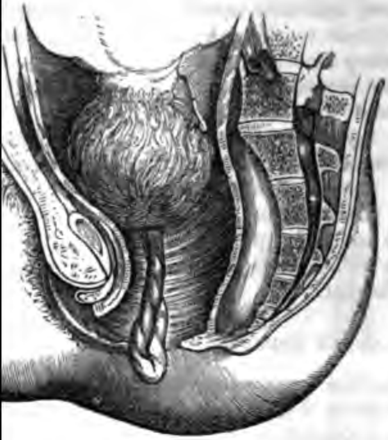
## PROLAPSUS OF THE CORD,

Whenever it occurs, may become a cause of preternatural labour. It may be produced in various ways, as for instance, by transverse presentation; by over-distension of the uterus by a large quantity of liquor amnii; by sudden rupture of the membranes and a gush of the contained fluid; by presentations of the feet or knees, the lower portions of the uterus not contracting sufficiently around the child; and by excessive length of the cord. (Fig. 40.)

The *prognosis* is, of course, unfavourable, the child being very liable to perish from asphyxia produced by pressure upon the cord.

*Treatment.*—Various expedients have been resorted to, in order to replace the cord, none of which have been entirely successful.

Fig. 40.



It has been proposed to push it up beyond the brim and hold it there till the head has engaged; or to hook it over the limbs of the child; or to enclose it in a little bag attached to a catheter or slender rod, then return it, withdraw the rod, and leave the bag and cord in the uterus. If, however, the head has descended, and the parts are in a favourable condition, it is better to use the *forceps*. If the woman has had children, the pelvis is

and the soft parts dilated, and the presenting part not
ded too low, the child may be turned. Should the cord have
to pulsate, we need not interfere.

UTERINE HEMORRHAGE.

ere are three varieties of hemorrhage treated of by obstetrical
s, viz.: *accidental; unavoidable;* and *hemorrhage after de-*
. The first generally occurs before or during labour, and arises
a partial and accidental separation of the placenta, which is
lly in its usual position.

*immediate cause* of the flooding is the separation of some
n of the placenta from the womb, and laceration of its vessels;
*emote cause* may be undue muscular exertion; blows; falls;
l excitement; straining at stool; general plethora, &c.

*gnosis.*—This variety of hemorrhage is distinguished from
which depends on implantation of the placenta over the cervix
by these circumstances: the os uteri may be felt on examination
ntain nothing but the bag of waters; that the hemorrhage
during the interval of the pains, and is arrested by the uterine
ctions; and that we can generally make out some definite
for accidental hemorrhage, and its occurrence is irregular.

en the blood which is poured forth from the uterine vessels
separation of the placenta, is at once discharged externally,

the nature of the case is clear. But it may happen that the blood may be poured into the bag of membranes, or between the membranes and the womb, without appearing externally, and may thus prove fatal, without the practitioner being aware of the danger.

This condition of things may be suspected, if, towards the end of pregnancy, the patient is subjected to any of the above causes that may produce hemorrhage, and if she complain of dull aching pains in the back, tenderness of the womb, with, perhaps, obvious swelling at some part of it, together with faintness, and the constitutional signs of loss of blood.

*Treatment.*—If the patient has not arrived at her full time, the hemorrhage is not profuse, and the os uteri undilated, there is no immediate danger. She should be placed in a horizontal position on a hard mattress, and lightly covered; cold applications to the pubes, or cold enemata, should be used. Internally, the infusion of rose leaves and aromatic sulphuric acid, or acetate of lead and opium, should be administered.

Should these measures not succeed, recourse may be had to the tampon. It should be remembered, however, that this instrument should never be employed when the uterus is *empty*, as the blood might collect within the cavity till the woman perished from the loss.

Should these means fail, there still exists another, viz.: *rupturing the membranes* and allowing the liquor amnii to escape. As soon as this is done, the uterus contracts, compresses the orifices of the bleeding vessels, and thus arrests the hemorrhage.

Should the contractions not come on, the organ may be stimulated by the administration of ergot, and friction over the abdomen. The os uteri is generally so relaxed by the hemorrhage as to be very dilatable. It has also been proposed, if all these fail, to introduce the hand, turn the child, and thus terminate the labour.

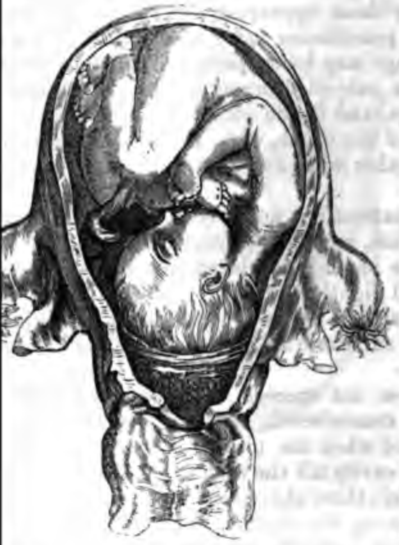
The placenta is usually expelled immediately after the child; if it be not, it is much better to extract it, and secure a firm contraction of the uterus, than to allow the hemorrhage to continue.

If the patient's strength is much exhausted, stimulants should be used, and nutritious articles of diet exhibited. It is generally considered advisable to keep down the reaction that succeeds excessive hemorrhages, by the administration of opium, combined, if necessary, with some stimulants. The patient should be kept in a strictly horizontal position till all danger of a recurrence is past.

## UNAVOIDABLE HEMORRHAGE.

*Placenta prævia; placental presentation.*—The hemorrhage which results in this case is the necessary and unavoidable consequence of the dilatation of the os uteri, by which the connexion

Fig. 41.



between the placenta and uterus is separated; the greater the separation, the greater the hemorrhage, as the labour advances. The placenta may be situated partially, or entirely over the os uteri. (Fig. 41.) The *cause* of the hemorrhage is the separation of the placenta from the cervix uteri, and the consequent exposure of the mouths of the bleeding vessels.

*Symptoms.* — The first discharge generally occurs from about three to five weeks before labour commences; the amount varies, but is generally slight at first and unaccompanied by

It returns again after a week or so, and without any apparent
and thus comes and goes till the end of gestation. With the
ensible contractions, the flooding occurs more profusely, and
n to increase *during* each pain. An internal examination is
ary to discover whether the implantation be complete or not.

*gnosis.*—This variety of hemorrhage is distinguished by the
hat it usually begins without evident cause, and that it is in-
d *during* a pain ; a per vaginam examination also reveals the
ce of the placenta, which is distinguished from a clot of blood
being firmer and not breaking down under the finger. If it
artially covers the os uteri, its edge will be felt continuous
he membranes, and through the latter the presentation may
s be felt.

*atment.*—If the hemorrhage is slight and the term of gesta-
not completed, palliative measures should be tried as before
bed. If so profuse as to demand interference, there is no
f a natural termination, unless the pains be so violent as to
away the placenta before the child. This, however, is so
not to justify waiting. The only alternative is to turn and
r as quickly as possible. It fortunately happens that the
ued bleeding so softens the os uteri as to render it speedily
le.

The hand is to be introduced in the usual manner, and insinuated between the os uteri and the placenta, on that side on which the placenta is believed to be thinnest; the membranes should then be ruptured as high up as possible, and the feet seized and brought down. When the body of the child is in the pelvis it will act as a tourniquet, and compress the bleeding vessels. Nevertheless, the labour should be terminated as early as possible.

Some authors recommend that the hand should be pushed *through* the placenta—a thing much more difficult to effect. The placenta should always be delivered as quickly after the child as possible, and every care taken to prevent a recurrence of the hemorrhage.

Some authors recommend that if the os uteri be undilated when the hemorrhage comes on, the *tampon* should be used till dilatation takes place. This has been objected to, on the ground, that it prevents the attendant from knowing when the os uteri is dilated or dilatable, and thus valuable time is lost.

If the feet present, it is more favourable, as the operation of turning is rendered easier. If the placenta is only attached to the edge of the os uteri, and the pains are active, it should be treated as a case of accidental hemorrhage, by rupturing the membranes. The pressure of the head whilst dilating the os uteri will close the mouths of the bleeding vessels with the placenta, and so arrest the flooding till the child is expelled.

Drs. Simpson, of Edinburgh, and Radford, of Manchester, recommend that instead of *turning* in these cases, the whole placenta should be *detached* and *extracted* if possible, before the child. The following are Dr. Simpson's conclusions, based on the examination of a large number of cases.

1st. That the complete separation and removal of the placenta before the child, is very seldom followed by any great hemorrhage.

2d. That, on the other hand, the previously existing hemorrhage almost always ceases from the moment the placenta is *perfectly* and completely detached from its connexions with the uterus.

3d. That the cessation of the hemorrhage is explicable, not on the idea that the descending head of the child acts as a plug or compress upon the exposed orifices of the uterine sinuses, but on the mutual vascular economy of the uterus and placenta, and the circumstance that the hemorrhage principally comes from the partially detached surface of the latter. The practice has been condemned by other eminent authorities, and it is recommended, even if it be adopted, to seize and bring down a foot if it can be readily found; if it be determined not to turn, it is also recommended to give a scruple of ergot at the moment of separating the placenta, so as to bring on early uterine contractions.

*Hemorrhage after delivery.*—The discharge in this case also proceeds from the mouths of the vessels exposed by the separation

partial or complete) of the placenta. A certain amount is
r the birth of the child; it is only when it becomes so pro-
to threaten serious consequences, that interference becomes
ry. It may occur after the escape of the head, while the
retained; immediately after delivery; or at the interval of
welve days after.

hemorrhage may arise from *inaction* of the womb; from an
of that contraction which is the only safeguard. The uterus
large and flabby in the abdomen; the pulse becomes weak
mulous; the patient restless; there are constant and deep
s and groanings, and frequent syncope, dimness of sight, and
in the ears, and even convulsions. These symptoms, toge-
th the escape of the blood, will be sufficient to establish the
is.

*tment.*—In every case, the indication is to *make the womb*
*t.* This may be done in various ways, viz., by friction to the
n; by the application of cold to the genitals, or abdomen;
ping the womb through the abdominal parietes; at the same
got should be administered to the same end. If these means
hand should be introduced into the cavity of the organ,
e hope of exciting contraction. It has also been recom-
to introduce ice into the uterus; or a freshly cut lemon,
n to squeeze out the juice upon the internal surface.

ng the internal remedies are, acetate of lead and opium;
nd magnesia. Pressure upon the abdominal aorta, and liga-
on the limbs, are highly praised by some authors. Velpeau
ends the application of a sinapism between the shoulders as a
t. Dr. Radford recommends galvanism as a powerful exci-
the uterine muscular fibres.

hemorrhage may, however, be attended with partial adhesion
placenta to the uterus, with an irregular spasmodic or *hour-*
ntraction of the latter organ. In this case, having placed
hand on the abdomen, so as to grasp and steady the womb,
ce the right hand, in a conical form, gently through the con-
portion of the womb; separate the placenta, and then the
tions of the uterus will probably expel the hand and placenta
r.

operation of transfusion has been recommended and practised
Blundell in cases of extreme danger from loss of blood, and
ved successful in fourteen cases, although it has failed in an
umber.

patient should be kept in a strictly horizontal position, and
pe occurs, the head should be lowered and the feet elevated,
allow the blood to flow to the brain. Stimulants should
administered, and the room kept cool and well ventilated.
er treatment is the same as in the cases already described.

## PUERPERAL CONVULSIONS.

There are three varieties spoken of by obstetrical writers, viz., the *hysterical*, the *epileptic*, and the *apoplectic*. The first occurs generally during the early months of gestation, and in females of a nervous or hysterical constitution. It is distinguished by the absence of insensibility, and frothing of the mouth, and the convulsive movements of the lower jaw. There is no stertorous breathing, and but slight contortion of the body; although in many cases, the muscles of the back are violently contracted, a symptom which is looked upon by Dr. Dewees, as pathognomonic of this form. The paroxysms often terminate in screams and tears, and the discharge of a large quantity of limpid urine.

*Treatment.*—If there be a quick, full pulse, or headache, venesection may be practised, or a few leeches applied to the temple. In general, the attack is relieved by antispasmodics, such as musk, camphor, valerian, or assafœtida. Cold water poured from a height upon the head will often break up the paroxysm. When it has ceased, a small dose of opium should be administered.

*Epileptic convulsions.*—The symptoms resemble those of an ordinary epileptic attack, and the patient often has premonitions of what is coming, from the presence of pain in the head, ringing in the ears, obscure or partial vision, loss of sensation, rigors, nausea, &c. The *aura epileptica* is seldom felt.

The *attendant symptoms* are, a turgid purple condition of the face; convulsive movements of the face and whole body; foaming at the mouth; repeated and sudden closure of the under jaw, by which the tongue is often dreadfully bitten; the respiration is at first irregular, and being forced through the closed teeth, and the foam at the mouth, has a peculiar hissing sound, which, once heard, can never be mistaken; the pulse is quick, full, and hard at the beginning, but afterwards becomes small and scarcely perceptible; the urine and faeces are often discharged involuntarily.

This fit lasts for a time varying from five minutes to half an hour, and then gradually subsides; the pulse often becoming calm, and the patient conscious; or she may remain in a state of complete coma with sibilant or stertorous breathing; the more profound the coma, the greater the danger.

The calm is generally short in duration, being often followed by a recurrence of repeated paroxysms and intervals.

Puerperal convulsions may come on either before, during, or after labour. When they occur before labour, uterine contraction is very apt to come on synchronously with the fit, and the child is born dead. When they occur during labour, the latter runs nearly its natural course, and the fits are synchronous with the pains, though not recurring with each. When they occur after labour, they generally e from two to four hours after the child is born, and are ble to some injury received by the brain and nervous system he parturient effort.

*uses* are generally a loaded state of the stomach or bowels; ance in eating or drinking; fright; and in most cases, an ation of blood in the brain during the violent expulsive Primiparæ are more frequently attacked than multiparæ.

*ment.*—The first indication is to protect the brain from the f an accumulation of blood. This should be done by taking od, in a full stream, from the arm, or temporal artery, and g it if the paroxysm continue. This may be followed by leeches to the temples and back of the neck; there is great e of bloodletting in this disease.

ong purgative should next be given (such as calomel and nd its operation assisted by stimulating enemata. It has n recommended to combine tartar emetic with the purge, or t alone, in divided doses, after the bowels are moved. The uld be shaved, and cold applications made to it.

gard to the *use of opium*, most practitioners are in favour of judiciously used. If it be given in the commencement of k, when the patient should be bled, it can only hasten the ult. But if the fits continue, *especially after delivery*, with great irritation and exhaustion, it may be given with the deriving benefit, remembering that depletion should always ised.

*ld the process of labour or parturition be interfered with?*

onvulsions occur during gestation, the uterus should not be d with. Should they occur at the commencement of labour, riety of interference may be questioned; the safest plan is o rupture the membranes (provided the os uteri is dilated or ), which sometimes hastens the progress of the labour. has been condemned. When the head has descended into is, and there is sufficient space, the *forceps* should be used. mpt should be made during an interval of the paroxysm; he fit recur at this time, the blade should be withdrawn, for njuring the mother.

d the head of the child be fixed in the pelvis, so as to be able with the forceps, it may be necessary to open the head. his is done, however, all the attendant circumstances should ully weighed; the child may be alive; the labour, if left to ay terminate naturally; and lastly, even if terminated by fits may not necessarily cease.

*lectic convulsions.*—Generally speaking, in this form there is no convulsions, no distortion of the face, and no frothing at th; the muscles are flaccid and powerless; the respiration is stertorous, the patient is insensible, and there is generally no repetition of the paroxysm.

The attack is generally preceded by headache, ringing in the ears, total or partial blindness, and flushing of the face. The pulse is full, slow, and laboured during the attack, and the pupils insensible to light. This form almost always occurs during labour, and is caused by the violent strain upon the cerebral vessels during the expulsive efforts.

*Treatment.*—Bloodletting in a full and copious stream, either from the arm, jugular vein, or temporal artery. This should be repeated if needful, or followed by local depletion, in the form of cups or leeches. If the patient is benefited by it, the head should then be shaved and ice applied, and the bowels freely evacuated.

If this variety occur during labour, and the uterine action be suspended, the patient should be delivered as speedily as possible, in order to save the child; for this purpose, if the head be within reach, the forceps should be applied. The after treatment of all these cases requires the greatest watchfulness and quiet. Should the patient become maniacal, all sources of irritation, within and without, should be removed, the patient kept quiet in a dark room, and under the influence of tartar emetic.

## PUERPERAL FEVER.

This malady has received various names, such as *childbed fever, puerperal fever, peritoneal fever, puerperal peritonitis, low fever of childbed,* &c.; by some it has been considered as a fever dependent on local inflammation, by others as a blood disease. Each author who has written upon the subject, has adopted a classification in accordance with his own views and experience; it would be impossible, therefore, in a work of this kind, to give a synopsis of *all.* "The student is liable to be deceived, if he grounds his ideas of this malady solely on the observations of one or two writers, especially those who have witnessed epidemics as they have appeared in hospital practice, however graphic the representations may be; because scarcely any two have resembled each other; and because the symptoms in all cases are much modified by the temperature and other qualities of the atmosphere, the season of the year, the localities in which the disease appears, and several external circumstances, independently of the constitution of the patient herself."*

There may be said to be *five* principal varieties of this disease. The *first* and most common variety is characterized by pain and tenderness in the abdomen, preceded by a chill, and accompanied by a hot skin, rapid pulse, and sometimes profuse perspiration. In

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* Ramsbotham, p. 4[illegible].

[illegible] meninges, or the peritoneum, receive [illegible].

[illegible] assumes the character of a mild typhus, accom- [illegible]. It is ushered in by rigors, followed [illegible] vomiting or diarrhœa, [illegible]. The tongue, at first loaded and [illegible] preternaturally red, as in those affected by [illegible] dry and hot, and of a dusky yellow [illegible], without being absolutely delirious: the [illegible] tremulous. In some cases these [illegible] acute inflammation of some important [illegible], softening of the womb, suppuration of its [illegible]. There is usually suppression of the milk, and [illegible].

[illegible] main mischief seems to be expended on [illegible] great delirium, agitation and sense of [illegible] is liable to be followed by fatal syn- [illegible] supervene in either of the others.

[illegible] form of puerperal fever affords the most [illegible] diffusion of a poison over the system [illegible] presents the most perfect analogy with scar- [illegible] and abdominal pain, are followed by [illegible], glassy eye, and dusky skin. There [illegible], husky cough, laborious breathing, and [illegible] of the lungs, which after death may [illegible] abscesses of the joints and cellular tissue; [illegible] the intestines, are among the ravages of [illegible].

[illegible] *symptoms* which may be added to those [illegible] characterizing the different forms. The pulse [illegible] ranging from 110 to 140, or 160; in the in- [illegible] and hard: in the adynamic, weak and [illegible] present, though most generally; there [illegible] generally constipation. The lochia and [illegible] suspended: the urine is suppressed, or voided with [illegible] tenesmus are present; and there is often [illegible] green bitter matter, and in the last stage a [illegible] *vomit*. The intellect is often undis- [illegible] the patient often takes a great aversion to [illegible].

[illegible] *causes* have been laid down as productive of this dis- [illegible] *among* the predisposing, are atmospheric vicissitudes, de- [illegible] passions, unhealthy residences, dissipation, bad diet, &c. [illegible] the *exciting* are, epidemic influences, intestinal irritation, [illegible] placenta, difficult labour, suppression of lochiæ and lacteal [illegible], and *contagion*.

:se must be had to bloodletting, which must be pushed to the
t of syncope, if necessary. The abdomen should then be
d with leeches, which are to be followed by hot fomentations.
owels should also be freely opened with a purgative, after
calomel and opium should be administered, with the view of
cing their constitutional effects.

the *second form*, bleeding, except in the early stage, will be
lly improper, and even then should be restricted to plethoric
ts. The principal reliance must be placed on purgative medi-
es salines and mercurials. A full dose of calomel should be
ed, and followed by a purgative; after free evacuation,
l and opium should be administered. After the bowels are
ed, purgation should cease, as it rather causes depression;
ials and salines, or tonic stimulants and carminatives, should
ed, according as the disease shows marks of excitement or
sion. In the low form, bark, camphor, or ammonia appear
particularly indicated.

the *third* or nervous form, warm purgatives should be ad-
ed, or laxative enemata, after which a few doses of opium
be exhibited. Bloodletting is generally uncalled for.

e *fourth* variety, the two indications are: *First*. To attend to
al lesions. *Second*. Never to forget that these are not the
e, but merely the effect of a more diffusive, though concealed
act on which our remedies should be directed. The
of the treatment, therefore, consists in the exhibition of
dies as will act on the cause, and such as will alleviate or
e local affections; taking care that in our attempt to effect
end, we do not so act on the constitution as to give addi-
rgy to the more deadly power of the concealed cause.

the pulse, at first small and hard, soon becomes developed,
e skin hot; the breasts grow hard, swelled, and painful in a
urs, so as to prevent the motion of the arms. This condition
gs is followed by a sweat, and the fever abates in the
of twelve or twenty-four hours, and the secretion of milk
blished; the breasts, however, remain tumid and painful
beyond this period, especially in women who do not give
The lochia, too, are often suspended or diminished during
me.

*atment.*—The bowels should be freely moved by the adminis-
of a saline cathartic, or oil. If the fever runs high, a small
ng should be practised. If the breasts are painful to the
they should be covered with warm emollient poultices, and
relieved by this, a few leeches should be applied to them.
se means are important to prevent the formation of a mam-
abscess. The breast should not be allowed to fill with milk,
ould be drawn either by the child or artificially, as often as
mes distended. Should suppuration unfortunately take place,
s should be evacuated as soon as possible, and a warm
c applied. If sinuses remain from the burrowing of pus,
ssion should be made upon the gland by means of adhesive
If a milk fistula should be the result, the orifice should be
vith a tent, and the wound allowed to granulate from the

## INVERSION OF THE WOMB.

inversion may be either partial or complete. *Partial inver-*
ay be known by the absence of the fundus behind the pubes,
e presence of a large solid tumour in the vagina, accompanied
fuse hemorrhage, intense pain in the pelvis, violent tenesmus,
ng, fainting, cold, clammy sweat, and feeble or imperceptible

*plete inversion* is recognised by the presence of a reddish,
umour, filling the vagina, and protruding beyond it, resem-
in shape the uterus after delivery. The os uteri may be felt
superior extremity of the tumour, forming a kind of circular
ing at its apex, and the uterus is wholly wanting in the hy-
ric region.

*ses.*—It may occur spontaneously in atony of the uterus, or
rregular contractions. Violence in extracting the placenta;
ss of the cord, delivery in the upright position, tumours of
rus unconnected with parturition, have all been mentioned as
of this accident.

*tment.*—By some it is recommended to compress the tumour
ss it in through the vaginal orifice, followed by the hand,
when in the vagina, should be formed into a cone, and made

to press mainly upon the fundus uteri; after a while it will be found to recede, and on being farther pressed, it suddenly starts from the hand, and the organ is returned to its natural condition.

Others advise that no compression be made; the womb should not be handled, but watching it carefully, at the moment when free from contraction, the fundus should be pressed with one finger and indented like the bottom of a bottle; when that much is effected, the reposition is sure, provided continual pressure be made: the fundus will be pushed up again through the os uteri and vagina, until the hand is found high up in the cavity of the uterus.

If the placenta be adherent, some recommend that it be reduced with the fundus; others, and the majority, that it be first removed, and then that reduction take place, as this procedure will facilitate the operation.

THE END.

A

# HAND-BOOK

OF

# MATERIA MEDICA

AND

# THERAPEUTICS.

AND

# THERAPEUTICS:

With Twenty-nine Illustrations.

BEING A PORTION OF

AN ANALYTICAL COMPENDIUM

OF THE

# VARIOUS BRANCHES OF MEDICINE.

BY

JOHN NEILL, M. D.,

SURGEON TO WILLS' HOSPITAL, DEMONSTRATOR OF ANATOMY IN THE UNIVERSITY OF
PENNSYLVANIA, LECTURER ON ANATOMY IN THE PHILADELPHIA MEDICAL
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SECOND EDITION, REVISED AND IMPROVED.

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# MATERIA MEDICA.

MEDICINES are substances which have the power of so modifying the actual state of the organs—the solids and fluids,—as to render them applicable to the cure of disease. They differ from *remedies*, which are of a more generic nature, and which include all the various means—moral as well as physical—employed to alleviate or cure disease: thus heat, cold, electricity, a surgical operation, the influence of the emotions, &c., are all remedies, but cannot be called medicines.

MATERIA MEDICA is the science which treats of medicinal substances; THERAPEUTICS—the application of remedies to the treatment of disease; PHARMACY is the art of compounding or preparing medicines for use; TOXICOLOGY embraces the consideration of their *poisonous* effects.

A complete knowledge of medicines includes an acquaintance with their *physical characters*, such as of colour, taste, odour, general appearance; their *chemical properties;* their *natural* and *botanical history;* their *modes of growth, collection, preservation*, &c.; their *therapeutical applications;* their *physiological properties*, or their method of affecting the healthy system; and their *toxicological properties*, or their poisonous effects. It is hence obvious that a correct knowledge of Materia Medica presupposes some acquaintance with Natural History, Botany, and Chemistry; and that of Therapeutics requires some familiarity with Anatomy and Physiology, and also with the principles of Mental and Moral Philosophy, as well as of the general powers or forces of nature, such as light, heat, electricity, and magnetism.

Along with medicines proper, it is usual to consider a set of substances called *aliments*, which are often very useful as therapeutic agents, though they cannot be considered as *medicinal* in their action. They possess nutritive qualities, and when swallowed, they are digested and converted into chyle. Medicines, on the contrary, produce their effects upon the system, not by undergoing change through the digestive process, and becoming thereby *assimilated*, but either by being absorbed into the circulation, and thus influencing the blood and the various secretions by virtue of some

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ain medicines have been found to evince a natural preference tain organs; thus, an emetic for the stomach, a cathartic for wels, &c.; and this, too, no matter in what way the medicine oduced into the system; thus tartar emetic or emetia will even if injected into the blood-vessels. No satisfactory ex- on can be given of this; we can only ascribe it to a *natural* supposed to exist between the medicine and the particular out this is obviously no explanation of the phenomenon.

in, medicines are sometimes regarded as divisible into two e classes—*stimulants* and *sedatives*. This, however, cannot be affirmed, since different states of the system may produce pposite results from the same medicine. This is well illus- in the effects of the too long-continued use of tonics and nts; the result is debility.

## RCUMSTANCES MODIFYING THE ACTION OF MEDICINES.

re are various circumstances which modify the action of medi- pon the system; these may depend upon the medicine itself, ects its dose, mode of combination, &c., or upon the condi- the organism at the time of its administration. Under the ead, the most important circumstances are:—

**GE.**—The young are much more susceptible to the action of nes than the middle-aged. Old persons are less able to bear rdose than the middle-aged. It is difficult to lay down any rule upon the subject: that of Dr. Young is often adopted; to diminish the dose of most medicines, for children under rs, in the proportion of the age to the age increased by 12;" 2 years it would be $\frac{2}{2+12}=\frac{1}{7}$, &c. At 21, the full dose may n. There are certain medicines, however, which cannot be o young children according to the above rule; thus calomel stor oil require to be given in larger proportionate doses; the narcotics, and some of the metallic preparations, must be stered in much smaller proportionate quantities.

**EX.**—Females, as a general rule, require smaller doses than The peculiarities of their system, at the different periods istruation, pregnancy, and lactation, must also be borne in

**ABIT.**—The effect of habit, in accustoming to the action of cine, is well known; it is well illustrated in the case of alco- d opium. The influence of acrid or irritating substances is tle diminished by repetition.

**ISEASED CONDITION OF THE BODY.**—This is well seen in the of the system to bear very large doses of opium in tetanus nia-à-potu, and of the different effects of calomel in different ons of the system.

5. **Temperament and Idiosyncrasy** will also modify the action of medicines. These should always be ascertained in the administration of our remedies.

6. **Tissue, or organ.**—The stomach is much more susceptible than the skin; carbonic acid, when inhaled into the lungs, acts as a poison; when swallowed into the stomach, it merely proves a grateful stimulant.

7. **The time of administration** also exercises an influence; a medicine acts more promptly and powerfully on an empty stomach.

8. **Mental emotions.**

## ADMINISTRATION OF MEDICINES.

Under this head may be included the parts to which medicines are applied, with the mode of their application, and the forms in which they are employed.

The parts of the body to which medicines are most usually applied, are the stomach, rectum, skin, mucous membrane of the lungs, nostrils, vagina, bladder, and urethra.

The *stomach* is most frequently resorted to, both on account of the facility of administration through it, its great susceptibility, and its intimate relation with other parts.

The *rectum* is employed, where the patient cannot swallow the medicine, or where there is some objection for giving it by the mouth, or when a local impression is desirable. Medicines thus employed are called *enemata*, or *clysters*, or *injections*. If introduced in the solid state, they are named *suppositories*. The dose of the medicine, as a general rule, is three times that given by the stomach, though there are exceptions. When intended to be retained so as to impress the system, the *bulk* of the vehicle should be as small as possible.

The *skin* is frequently made use of as a means of affecting the system by remedies. These may be applied either *epidermically* or *endermically*,—that is, to the sound skin, or to the skin deprived of its cuticle. The endermic method is by far the most prompt and powerful. The cuticle is best removed by means of a small blister: and the proper parts for the application are the epigastrium, and the insides of the limbs. The usual dose is three times the quantity given by the mouth; and the powdered substance should be properly diluted, before being sprinkled upon the denuded surface. The circumstances which may demand the endermic method of administration are inability or indisposition of the patient to swallow, or of the stomach to retain the medicine; inflammation of the gastric mucous membrane, or a want of susceptibility of this part to the action of the medicine, from frequent repetition; the necessity, in urgent cases, of introducing medicines in all possible modes; the

ion that may exist to produce revulsion from internal parts;
e necessity for procuring the local effects of the remedy.
n the cuticle is not removed, the medicines may be applied
ous manners; thus, where their local effects alone are wanted
otions, fomentations, cataplasms, &c.; where their general
sion is desired—by inunction, baths, and vapour. The most
form of administering a vapour bath, is to elevate the pa-
knees under the bedclothes, and to place at his feet hot bricks
ped in wet flannels; the vapour which is given off has thus
cess to the body. Another method is to place the patient in
of warm water, enveloping him in a blanket, after which a
r of hot bricks are to be placed in the tub, until the requisite
t of steam is generated. Another method, recommended by
rres, is to place a piece of quick lime in a wet cloth, and then
t up in a dry cloth, and place it in the bed. If the vapour
olid substance, as sulphur, is required, the patient is to be
in a properly-contrived apparatus, and the solid body sprin-
n powder on a hot iron at his feet.

*mucous membrane of the bronchi* may also be employed for
roduction of medicines. They are applied here usually in the
f vapour, by means of an inhaler; or, when this cannot be
y means of a teapot or basin, with an inverted funnel. It is
ommended to blow fine powders into the lungs.

asionally, medicines are introduced through the *nasal* or *pitui-
embrane;* they are however employed, in this manner, gene-
vith a view to their local impression. When they produce a
rge, they are called *errhines;* when sneezing, *sternutatories.*

practice of *introducing medicinal substances through the veins*
en occasionally resorted to; but it is not recommended, in
uence of the danger of the introduction of air, which is
ed with fatal consequences.

## FORMS OF MEDICINES.

icines are used in the solid or fluid state, each of which com-
several forms.

### I. SOLID FORMS.

se include *pills, powders, confections, troches, electuaries,* and
*s.*

s. (*Pilulæ,* U. S.)—Small globular masses, intended to be
ved without chewing; they should not consist of substances
ng to be given in large doses, nor of salts which are deliques-
efflorescent, although the latter may be rendered fit by first
off the water of crystallization by heat. Some substances
only the addition of water; others, the intervention of some

viscid body, as gum or sugar. The heavy metallic powders may be mixed with soft extracts or confections; the light vegetable powders, with syrup, honey, or mucilage. When the requisite consistence has been given to the mass, it is to be properly rolled out by means of a spatula, and then divided into the requisite number of pills. Sometimes they are covered with gelatine, to conceal their disagreeable taste.

POWDERS. (*Pulveres*, U. S.)—Such medicines are given in the form of powder as are not very bulky, nor of very disagreeable taste, and have no corrosive property. Deliquescent substances, and those containing much fixed oil, are unfit to be used in powder; as also such crystalline salts as contain water of crystallization, unless this be previously expelled by heat. The substance may be reduced to the state of powder by means of a mortar and pestle, made either of metal, glass, or Wedgwood. The coarser particles are separated by sieves made of various materials. Some require to be submitted to the processes of *levigation* and *elutriation*. By the former of these terms is meant the rubbing of the substance, previously moistened, between two smooth pieces of hard flat stone; the latter term signifies the agitation of the matter in water, allowing the coarser particles to settle, pouring off the liquor for the finer ones to subside, and lastly, decanting and drying the powder. Some medicines deteriorate when kept in the powdered state. They are also more liable to adulteration.

The lighter powders may be administered suspended in water, or any other convenient vehicle: the heavy insoluble ones, in syrup, molasses, or honey.

TROCHES. (*Trochisci*, U. S.)—Small solid masses, in which the medicinal substance is incorporated with the sugar and gum,—intended to be held in the mouth and allowed slowly to dissolve. They are used chiefly in affections of the throat.

CONFECTIONS. (*Confectiones*, U. S.)—Soft solids, made by incorporating medicinal substances with sugar: they comprise also *conserves*.

ELECTUARIES. (*Electuaria.*)—Usually extemporaneous prescriptions, made by mixing medicines (generally powders) with honey or molasses.

EXTRACTS. (*Extracta*, U. S.)—These are either solid or fluid. The former are usually prepared by evaporating either the expressed juice, or the infusion or decoction; the latter, by the addition of sugar to the concentrated infusion, decoction, or tincture.

### II. LIQUID FORMS.

These include *decoctions*, *infusions*, *solutions*, *medicated waters*, *mixtures*, *tinctures*, *wines*, *spirits*, *ethers*, *oils*, *syrups*, *vinegars*, *oxymels*, and *honeys*.

OCTIONS. (*Decocta*, U. S.)—Preparations in which the active ties of vegetables are extracted by boiling. The boiling should ace in a covered vessel. Certain vegetables are unfit for de- , as those which possess a volatile oil, or such as contain inert, starchy, or mucilaginous matter.

USIONS. (*Infusa*, U. S.)—These differ from decoctions in not boiled. They may be made either with cold or boiling Cold water is preferred where the active principle is vola- easily injured by heat, or where it is desirable to avoid the n of some principle which is insoluble at a low temperature. nfusions and decoctions usually require to be *filtered;* this may be performed either by using unsized paper in a common , or by *percolation* or *displacement.*

UTIONS. (*Liquores*, U. S.)—Preparations in which substances nply dissolved in water; as *liquor calcis* or *lime-water.*

ICATED WATERS. (*Aquæ Medicatæ*, U. S.)—These are water gnated with different essential oils; they are usually made by bbing up the oil with carbonate of magnesia, and then adding ter, and filtering.

TURES. (*Misturæ*, U. S.)—These consist generally of one or nsoluble substances, suspended in water by means of gum, or yolk of egg. When an oil is suspended in this way, the e is called an *emulsion.* A good deal of care and dexterity uisite in making a uniform mixture.

CTURES. (*Tincturæ*, U. S.)—Solutions of medicated sub- in alcohol, or diluted alcohol. They are usually macerated, inary temperatures, in well-stopped bottles, frequently agi- *Undiluted* (officinal) alcohol is employed where the sub- to be dissolved is insoluble in water,—as resins, essential c.; but *diluted* alcohol is preferred when the substance is both in alcohol and water.

IES. (*Vina*, U. S.)—Are solutions in wine. The only wines for use are Madeira, Sherry, or Teneriffe.

RITS. (*Spiritus*, U. S.)—These are alcoholic solutions of principles, and are prepared either by distillation, solution, naceration.

ERS. (*Ætherea*, U. S.)—These require the action of acids on l.

S.—The *distilled oils* (*Olea Destillata*, U. S.) are prepared illation from the substances containing them. The *fixed oils* *Fixa*), by expression; as *olive oil*, &c.

UPS. (*Syrupi*, U. S.)—Preparations in which the medicinal nce is preserved in a concentrated solution of sugar. *Simple* consists of two and a half pounds of white sugar dissolved in of water. *Medicated* syrups are made either by adding the amount of sugar to vegetable infusions, decoctions, juices,

&c., or by adding the tincture of the substance to simple syrup, and afterwards driving off the alcohol by the heat of a sand bath.

HONEYS. (*Mellita*, U. S.)—These are analogous to syrups, the difference being that honey is employed to preserve the medical substance, instead of a solution of sugar. They are said to be less apt to become candied.

OXYMELS are preparations in which honey and vinegar are combined.

VINEGARS. (*Aceta*, U. S.)—Liquids in which distilled vinegar is employed as the solvent.

Besides the above forms of medicines, which are employed for internal administration, there are several others which are used exclusively as external applications; these are *liniments, ointments, cerates, plasters,* and *cataplasms.*

LINIMENTS. (*Linimenta*, U. S.)—Oily compounds intended to be applied to the surface by bathing, or by saturating cloths with them.

OINTMENTS. (*Unguenta*, U. S.)—Soft solids which melt at the temperature of the body.

CERATES. (*Cerata*, U. S.)—These are rather harder than ointments: they do not melt at the temperature of the body. *Simple cerate* consists of fresh lard and white wax.

PLASTERS. (*Emplastra*, U. S.)—These are solid at ordinary temperatures, and require to be heated before they can be spread. They are usually kept in rolls, and when wanted for use are spread upon sheepskin, linen, muslin, or even paper; a small margin being left at the edges uncovered.

CATAPLASMS *or* POULTICES.—These are soft moist preparations, intended to relax and soften the parts to which they are applied. They are usually made from bread and milk, flaxseed meal, &c.

The *weights* and *measures* recognised by the Pharmacopœia in the compounding and dispensing of medicines are the *Apothecaries' weight*, and the *Apothecaries'* or *wine measure*, though medicines are purchased and sold by the wholesale dealer by the *Avoirdupois weight.* The imperial pint of the British Pharmacopœia (not recognised by the U. S. Pharmacopœia), contains *twenty* fluid ounces. The common pint contains only *sixteen* ounces.

The following are the denominations, together with their symbols, which are employed in prescription:—

Pound, ℔; ounce, ℥; drachm, ʒ; scruple, ℈; grain, gr.; gallon, Cong. (congerius); pint, O (octarius); fluid ounce, f℥; fluid drachm, fʒ; minim, ♏.

A *drop* is not always equivalent to a minim, since it varies in size according to the nature of the fluid, and the shape and size of the vessel from which it is dropped. In the case of water, the minim and drop are the same; in alcohol there are two drops in each minim; in ether, there is a still greater difference. *Chloroform* contains from 250 to 300 drops in a fluid drachm.

des the above weights and measures, it is frequently found ient to employ *approximative* measurements, in prescribing ıes. The following are the most common:

,—estimated to hold about four fluid ounces, (f ℥iv.) or a gill.
*lass*, " " two fluid ounces, - (f ℥ij.)
*poon* (cochlear magnum), - - - (f ℥ss.) half a fluid ounce.
*on* (cochlear parvum), - - - - (f ʒj.) a fluid drachm.

## CLASSIFICATION OF MEDICINES.

great diversity of the effects of different medicines, renders ːmpt at their classification very desirable. Classifications of ıes may be divided into *empirical* and *rational* ones. As an le of an empirical classification, the *alphabetical* order may l, since this method is founded on names which are arbitrary, ve no relation to the bodies which they are intended to repre- All its supposed advantages—as, for example, that of facility rence—may be obtained from a well-constructed index.

*rational* arrangements are such as have an actual relation ıe bodies for which they are used, being founded on the pro- of the medicines themselves, or on their mode of affecting onomy. Thus medicines may be grouped, according to (1) *ensible* properties, as colour, taste, and smell; (2) their *chemi-* operties; (3) their *natural-historical* properties; (4) their *eutical* properties; (5) their *physiological* properties.

d objections may be urged against all the above systems of ement, with the exception of the *physiological* system, which adopted, as being the safest guide both to the student and ioner.

he *physiological classification* is meant one founded on the ı which medicines bear to the system in a state of health. nes may be arranged *physiologically*, on two principles,—ac- g to the parts or organs which they affect, or according to ure or quality of the action which they set up. It would be impossible to base an arrangement exclusively upon either se methods; but some authors form their principal divisions *ses* of medicines from the parts acted on, and their *orders* he nature or quality of the effect, or *vice versâ*. The fol- system of classification is founded upon the *physiological* l.

icines may be considered as acting either upon the solids and of the body, or upon foreign matters contained in the body. fords the grounds for their primary division into two separate : most medicinal substances belong to the former class.

hose medicines which act upon the solids and fluids of the some may exert their influence upon the system at large, through the medium of the circulation or that of the nervous system; whilst others confine their operation to some especial organ, as the kidneys, the lungs, the skin, &c.: the former are termed *general remedies;* the latter, *local remedies.*

General remedies are divisible into three orders: stimulants, which elevate the system above the natural standard; *sedatives,* which depress it below the natural standard; and *alteratives,* which act by slowly changing the nutrition, and thereby superseding diseased action.

Stimulants may be divided into *permanent stimulants* and *diffusible stimulants;* the former include the two ultimate classes of *astringents,* or medicines which excite the vital contractility of the tissues; and *tonics,* which increase the vital tonicity of the system. Diffusible stimulants include the two divisions of *arterial stimulants* and *cerebro-nervous stimulants.* The latter are divided into *cerebral stimulants,* or *stimulant narcotics; nervous stimulants,* or *antispasmodics;* and *excito-motor stimulants,* or such as affect the spinal centres so as especially to excite the motor nerves.

Sedatives comprise only the two ultimate classes of *arterial sedatives,* sometimes named *refrigerants,* and *nervous sedatives,* or *sedative narcotics.*

Local remedies are divided into three orders: *those affecting the functions; those affecting the organization;* and *those which act mechanically.* The medicines which affect the functions include the eight following classes: *emetics,* which act upon the stomach; *cathartics,* which act upon the intestines; *diuretics,* which increase the secretion of the kidneys; *diaphoretics,* which promote perspiration; *expectorants,* which increase the pulmonary and bronchial secretion, or facilitate its expulsion; *emmenagogues,* which facilitate the menstrual discharge; *sialagogues,* which stimulate the salivary glands; and *errhines,* which increase the secretion of the nasal mucous membrane.

The medicines affecting the organization comprise the three classes of *epispastics,* or such as vesicate or blister the skin; *rubefacients,* or such as inflame the skin; and *escharotics,* or such as destroy the life of the part.

The medicines operating mechanically are the *demulcents,* which act by protecting the surfaces to which they are applied, from irritation; *emollients,* which soften and relax the skin; and *diluents,* which act by diluting the fluids of the body.

The second great division, embracing substances which act on foreign matters within the body, comprises only two subdivisions: *antacids,* or medicines which neutralize acid in the system; and *anthelmintics,* or such as destroy and expel worms from the alimentary canal.

The following table presents a synopsis of the foregoing arrangement. It is the one adopted by Prof. Wood, and somewhat modified by Prof. Carson.

## TABLE OF CLASSIFICATION OF MEDICINES.

### BSTANCES WHICH ACT UPON THE SOLIDS AND FLUIDS OF THE BODY.

- ulants,
  - Permanent,
    - **Astringents.**
    - **Tonics.**
  - Diffusible,
    - **Arterial,**
    - Cerebro-nervous,
      - **Cerebral,**
      - **Nervous,**
      - **Excito-motor.**
- atives.
  - Arterial, or **Refrigerants,**
  - Nervous, or **Sedative Narcotics.**
- eratives.
- ecting the nctions.
  - Emetics,
  - Cathartics,
  - Diuretics,
  - Diaphoretics,
  - Expectorants,
  - Emmenagogues,
  - Sialagogues,
  - Errhines.
- cting the anization.
  - Rubefacients,
  - Epispastics,
  - Escharotics.
- ing me- nically.
  - Demulcents,
  - Emollients,
  - Diluents.

### II. SUBSTANCES WHICH ACT ON FOREIGN MATTER IN THE BODY.

- **Antacids,**
- **Anthelmintics.**

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# GENERAL REMEDIES.

## CLASS I.

### ASTRINGENTS.

EDICINES which produce contractility of the living tissues." fect is by some ascribed to a *vital* stimulant influence over ganic contractility; others attribute it rather to a *chemical* on upon the albumen and gelatine of the tissues. Their chemical effect is certainly controlled by vitality; but their hemical operation is much the same as upon dead animal

The obvious effects of astringents are contraction and shrinking of the parts to which they are applied, diminution of secretions, and of hemorrhagic discharges, a harder and fuller pulse, together with greater tonicity of the muscles.

They are used chiefly to arrest morbid discharges, whether hemorrhagic or by secretion; but they should not be prescribed in the early, or inflammatory condition. They are also used in diseases connected with relaxation of the tissues. Among the special disorders calling for their employment are *chronic diarrhœa* and *dysentery, passive hemorrhages, profuse bronchial discharge, catarrh of the bladder, &c.*; and *locally*, in gonorrhœa, leucorrhœa, otitis, eczema, and ulcers.

They may be conveniently divided into the two classes of Vegetable and Mineral astringents. The former depend for their astringency on a principle common to all of them, named *tannic acid;* the latter possess no such common principle, but each one of them is peculiar in its effects upon the system.

## VEGETABLE ASTRINGENTS.

**Acidum Tannicum**, U. S. (*Tannic Acid.*)—Exists in vegetable astringents in combination with *gallic acid;* the latter, indeed, is believed to be produced by the oxidation of tannic acid. It is best obtained by the action of commercial sulphuric ether on powdered galls, allowing it slowly to percolate through them; the water of the ether dissolves out the tannic acid, which may be separated by evaporation.

*Prop.*—A light porous substance, of a yellowish-white colour; very soluble in water and alcohol, and of a purely astringent taste. There are two varieties, one found in galls, oak-bark, &c., characterised by yielding a *blue-black* precipitate with the persalts of iron; the other found in kino, &c., yielding a *greenish-black* colour. *Incompatibles,*—mineral acids, alkalies, vegetable alkalies, the persalts of iron, and gelatine. It acts on the system as a pure astringent;—useful in diarrhœa and some forms of local hemorrhage. Dose, 3 grs., three or four times a day.

**Oak Bark.** (*Quercus.*)—The officinal varieties of oak bark, are the *Q. alba*, U. S., or *white oak bark*, and *Q. tinctoria*, U. S., or *black oak bark;* though other species may contribute to furnish the shops. White oak bark is recognised by its whitish epidermis and superficial furrows; internally, it has a light-brown colour and fibrous texture; taste, bitter and astringent; does not tinge the a. Black oak bark is darker coloured externally, more deeply wed, has a more bitter taste, and imparts a yellow colour to saliva in consequence of its containing a peculiar principle, citrine: this principle renders the black oak bark valuable as a. Both impart their virtues to water and alcohol. They con-

nnic and gallic acids. Not much used internally. The white
ingent; the black frequently purges from the irritation it
Oak bark is employed externally in the form of bath for
nus, or chronic diarrhœa; also as a lotion, or poultice, to in-
and gangrenous ulcers, and as a gargle in sore-throat. Dose,
der, 30 grs.; of the decoction (*Decoctum Quercus Albæ*, U. S.),
of the extract, 10 to 20 grs. The oak leaves and acorns are
tringent; the latter have been used in scrofula.

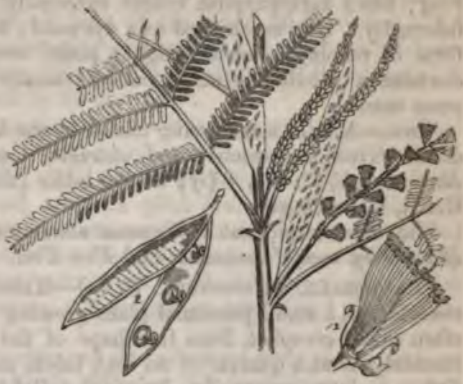
LS. (*Galla*, U. S.)—Excrescences produced by the puncture
insect upon the young twigs of the *Quercus infectoria*, a
of Asia Minor. The market is chiefly supplied from the
f the Levant; they are named *Aleppo galls*. There are two
es, the *blue* and the *white;* the former are the smallest, most
t, and most valuable; the latter are of a yellowish-brown
ghter, and have a perforation which indicates that the insect
they contained has made its escape. The blue galls are to
ferred; they have a flinty fracture, no odour, a bitter and
stringent taste, yield their virtues to water and alcohol; they
much tannic and gallic acids. *Incompatibles,*—the same as
in.

.—Chiefly externally, in the form of decoction, as a gargle,
n; also as an ointment (*Unguent. Gallæ*, U. S.), for piles.
f powder, 10 to 20 grs.; of the decoction, f℥ij. The tinc-
*Tinct. Gallæ*, U. S.) is chiefly used for a test.
*syrup* is used in chronic diarrhœa.

o, U. S.—An extract, or an inspissated juice of certain trees.
l varieties are noticed: 1. East India or Amboyna, from
*rpus marsupium;* 2. African—supposed to be the product
*Pterocarpus erinaceus*, of Senegal; 3. Jamaica or West
-derived from the *Coccoloba uvifera;* 4. Botany Bay,—the
e juice of the *Eucalyptus resinifera;* 5. Caraccas.—The one
used is the Amboyna or East India. It comes in small,
ar, angular fragments, of a dark reddish-brown colour,
fracture, no odour, but a very astringent taste. Soluble in
ter and alcohol. Active principle, that variety of tannic
hich affords a greenish-black precipitate with the persalts of

.—One of the most used, internally, of all the astringents;
ed frequently with chalk and laudanum in diarrhœa and
ry, not attended with inflammation; also in passive hemor-
leucorrhœa, and diabetes. Dose of powder, 10 to 30 grs.;
infusion (ʒij to f℥vj water), f℥ss.; of the tincture (*Tinct.*
U. S.) fʒss. to fʒij. Kino is used externally, as an injec-
gonorrhœa, leucorrhœa, and hemorrhages; also for indolent

Fig. 1.



CATECHU, U. S.—Extract of the *Acacia catechu*, a thorny tree growing in Hindostan. Procured by making a decoction of the wood, and then evaporating to a proper consistence. Formerly called *Terra Japonica*, from its supposed earthy origin. There are several varieties of Catechu, one of which is derived from the *Betel nut*, and another, called *cutch*, or *Gambir*, from the *Uncaria gambir* of Sumatra.

*Prop.*—Irregular masses of various sizes; colour, externally, rusty brown, lighter within; taste, bitter and astringent; active ingredient, the same variety of tannin as is found in kino,—which it resembles very much in all its properties. It also contains a principle called *Catechuic acid.*

*Uses.*—Same as kino. Dose of powder, 10 to 30 grains.

The compound infusion (*Infusum Catechu Compositum*, U. S.) contains ℥ss of catechu, ʒj of cinnamon, and Oj of boiling water; it is used in bowel-affections; dose, f℥ss–j. The *tincture* is preferable to the tincture of kino, in consequence of not gelatinizing; dose fʒj–ij. *Troches* of catechu are employed for relaxed uvula.

RHATANY. (*Krameria*, U. S.)—Root of the *Krameria triandra*, a small shrub growing in Peru and Brazil. The root is branching, and, as found in the shops, is in pieces of various sizes, from the thickness of a quill upwards; colour externally, dark reddish-brown; rather lighter within; taste, bitter, astringent, and sweetish; active principle, tannic acid, which resides most in the cortical portion;—imparts its virtues to water and alcohol.

*Uses.*—Same as those of kino; a strong and good astringent. The external application is very useful in *fissure of the anus*,—the saturated infusion, made by displacement, or the solution of the extract being used; likewise as an injection in leucorrhœa and gonorrhœa. Dose of powder, 20 to 30 grs.; of the infusion (*Infusum Krameriæ*, U. S.), best made by displacement (℥j to Oj water), f℥j to f℥ij; of the tincture (*Tinct. Krameriæ*, U. S.), fʒj to fʒij; of the extract (*Extractum Krameriæ*, U. S.), made by evaporating the

fusion obtained by percolation, 10 to 15 grs. There is also
); dose f℥j–iv.

wood. (*Hæmatoxylon,* U. S.)—Wood of the *Hæmatoxylon*
*chianum,* a large tree growing in Mexico, and other parts of
l America. It is imported in the form of billets, several feet
has a dark-purplish colour externally, and a bright-red hue
lly. It is much used as a dyewood; kept in the shops in the
f raspings; odour, slight; taste, sweetish and astringent;
ns a peculiar principle called *hematin* or *hæmatoxylin;* also
annin.

.—A mild astringent; useful in the bowel-affections of chil-
Given in decoction and extract; dose of former (*Decoctum*
*toxyli,* U. S.), f℥ij; of the latter (*Extractum Hæmatoxyli,*
10 to 30 grs.

most important indigenous astringents are the *Geranium,*
*erry root, Pipsissewa,* and *Uva Ursi.*

NESBILL. (*Geranium,* U. S.)—Rhizoma of the *Geranium*
*tum,* a small perennial plant growing in moist, shady woods;
alled *crowfoot,* from the shape of the leaf. The root is ho-
l, about a quarter of an inch thick, and furnished with short
colour, externally, brownish; lighter within; no odour;
stringent. Virtues depend on tannic acid, and are extracted
er and alcohol.

.—An excellent astringent; employed much in domestic
e, particularly in cases of children, to whom it may be given
in milk. Dose of powder, 20 to 30 grs.; of the decoction,
sion, f℥j to f℥ij.

CKBERRY ROOT. (*Rubus villosus,* U. S., DEWBERRY ROOT.
*s trivialis,* U. S.)—These two roots are identical in medical
ties and uses. They occur in pieces of various lengths, of a
sh colour, covered with a thin bark, which abounds most in
ive principle, tannic acid.

.—An excellent domestic astringent, much employed in
diarrhœas and dysentery; also in the latter stages of cholera
m. Dose of powder, 20 to 30 grs.; best given in decoction,
y boiling ℥j of the smaller roots in a pint and a half of water,
o a pint; dose, f℥ij. The *fruit* is slightly astringent and an
ble demulcent.

SISSEWA. (*Chimaphila,* U. S.)—Leaves of the *Chimaphila*
*ata,* sometimes called *Winter-green,* a small evergreen plant,
ous to both continents. It has a creeping root, which sends
ral erect stems, from four to eight inches high. The leaves
out an inch and a half long, serrated, of a green colour.
bruised, and in the fresh state, they emit an aromatic odour.
etain their green colour, if well dried. Taste, bitter, astrin-

gent, and aromatic; water and alcohol extract its virtues, which depend on tannin and a bitter extractive.

*Uses.*—Chiefly as a mild alterative tonic in scrofulous complaints, and in diseases of the urinary organs; also, in dropsy, attended with dyspepsia and debility. It is best given in the form of decoction and extract. Doses of the former (*Decoctum Chimaphilæ*, U. S.), f℥iv, several times a day; of the latter, 20 to 30 grs. An excellent mode of administering pipsissewa is in the form of *beer*, made by adding molasses, ginger, and yeast to the decoction. A good *infusion* is obtained by displacement.

Uva Ursi, U. S.—Leaves of the *Arctostaphylos Uva Ursi*, or *bear berry*, a small, trailing, evergreen shrub, growing in the northern parts of both continents. The leaves are obovate, about half an inch in length, thick and entire, a good deal resembling the box leaves. They are apt to be adulterated with the leaves of the red whortleberry. No odour when fresh, but acquire the smell of hay by drying; *taste*, bitter, astringent, and sweetish; virtues are yielded to alcohol and water, and depend on tannin and a bitter extractive.

*Uses.*—Chiefly in disorders of the urinary organs, as catarrh of the bladder, chronic nephritis, diabetes, and incontinence of urine. It is not, however, a certain remedy. Dose of powder, 20 grs. to ʒj, three times a day; of the decoction (*Decoctum Uvæ Ursi*, U. S.), —made by boiling ℥j in Ojss of water, down to Oj, f℥j to f℥ij.

There are a few other vegetable astringents, which are occasionally employed: these are the rind of the Pomegranate (*Granati Fructus Cortex*), the bark and unripe fruit of the Persimmon (*Dyospyrus*), and the Bistort and Tormentil roots.

The *Rosa Gallica*, or Red rose leaves, is also astringent; the confection (*Confectio Rosæ*, U. S.), and the compound infusion (*Infusum Rosæ compositum*, U. S.), are officinal. The *confection* is made by incorporating powdered red roses, sugar, honey, and rose-water together. The *compound infusion* contains some dilute sulphuric acid, which renders it slightly refrigerant. The Hundred-leaved Rose (*Rosa centifolia*, U. S.) is not astringent. The latter species furnishes the rose-water (*Aqua Rosæ*, U. S.) of the shops, and the *Unguentum Aquæ Rosæ*, U. S., or *cold cream*.

## MINERAL ASTRINGENTS.

Lead. (*Plumbum*, U. S.)—Not employed in medicine, in the metallic state. Its preparations are characterized by the union of astringent with sedative properties; and they may all be regarded as poisonous in over-doses, with the exception of the *sulphate*, which is extremely insoluble. The poisonous impression may be produced in two modes, either by their being absorbed into the blood, and

cting upon the nervous centres, or by their local irritant
Lead is very apt, when taken in improper quantities, to
ı series of symptoms called *colica pictonum*, or *painters'*
of which the most prominent are, loss of appetite, pain-
l constipated state of the bowels, acute pain about the um-
, with a knotty feel of the abdominal muscles, followed by
l cramps, convulsions, and death. It also occasionally pro-
ı paralysis, most generally of the upper extremities, denomi-
*'ead palsy*. These poisonous effects are generally the result
; exposure to the fumes of melted lead, and are usually met
n workmen of lead factories, painters, solderers, &c. It is
nended that such persons should use diluted sulphuric acid,
: purpose of converting any preparation of lead, which may
he system, into the sulphate.

*.arge.* (*Plumbi Oxidum Semivitrium*, U. S.)—Prepared in
traction of silver from the argentiferous galena. It is in the
f small semi-vitrified scales, of a flesh colour. They usually
ı some carbonic acid. Its chief use is in the preparation of
*'laster* (Emplastrum Plumbi, U. S.), made by boiling together
e, olive oil, and water; it consists of an *oleo-margarate of*
It is the foundation of most of the other plasters.

*bonate of Lead.* (*Plumbi Carbonas*, U. S.)—Called also
Lead. Prepared by exposing lead in thin sheets to the action
vapours of vinegar, at the temperature of fermenting manure:
ıegar furnishes oxygen and acetic acid, by which a *subacetate*
formed; and the decomposing manure yields the carbonic acid.

ɒ.—A white, heavy, insoluble substance, without smell and
one of the most poisonous of the salts of lead; not used as a
ne internally; occasionally applied to excoriated and burnt
:s; used also in the manufacture of the plaster (*Emplastrum*
*i Carbonatis*), made to imitate Mahy's Plaster. It is applied
sores. The *ointment* (*Unguentum Plumbi Carbonatis*, U. S.)
. for excoriated and abraded surfaces.

*'ate of Lead.* (*Plumbi Acetas*, U. S.)—*Sugar of Lead.*—Pre-
by dissolving litharge, or the carbonate in distilled vinegar,
aid of heat.

ɒ.—A white salt; crystallizes in needle-shaped forms; odour,
ır; taste, sweetish and astringent; effloresces on exposure;
ly soluble in pure water, but gives a turbid solution, if there
carbonic acid present. This may be remedied by a few drops
illed vinegar. *Incompatibles*, the mineral acids and their
salts, the alkalies, alkaline earths, and carbonates, and vege-
stringents.

.—Internally, in hemorrhages, particularly hæmoptysis; also
ıntery, cholera infantum, and in certain disorders of the mu-
ıembrane of the stomach, as in yellow fever, and malignant

remittents and intermittents. Dose, gr. ss to gr. ij, every two or three hours, according to circumstances. Used very much as a topical application, particularly in inflammations of the mucous membranes and the skin. The strength of the solution, for mucous membranes, is from gr. ss to gr. ij in f℥j of water; for the sound skin, ʒij dissolved in Oj of water.

*Solution of the Subacetate of Lead.—Liquor Plumbi Subacetatis*, U. S.—(*Goulard's Extract*).—Prepared by boiling together equal quantities of sugar of lead and litharge. It is not uniform in its strength, varying with the quantity of lead contained in the preparation. It is a colourless, limpid fluid, having a sweetish, astringent taste. It is decomposed by whatever is incompatible with the acetate, and also by gum and starch. It must be preserved in closely-stopped bottles, to keep it from the carbonic acid of the air.

*Uses.*—Never internally; externally, diluted, to sprains, bruises, burns, and ulcers, in the proportion of ʒij or ʒiij to the Oj of water.

*Lead Water.* (*Liquor Plumbi Subacetatis Dilutus*, U. S.)—Contains only ʒj to Oj of water. Used for sprains, &c.

*Goulard's Cerate.*—(*Ceratum Plumbi Subacetatis*, U. S.)—is made by boiling together Goulard's extract, white wax, olive oil, and camphor; it is an excellent application to abraded surfaces, and to blisters not disposed to heal.

The *iodide* and *nitrate* are also officinal.

ALUM. (*Alumen*, U. S.)—Chemically, a double sulphate of alumina and potassa; sometimes found native, though usually made artificially, either from some of the native ores of alum, or by a direct combination of the elements. Some varieties of alum contain sulphate of soda, or sulphate of ammonia, instead of sulphate of potassa.

*Prop.*—A white crystalline salt, slightly efflorescent, crystallizes in regular octohedrons: taste, sweetish and astringent; very soluble in hot water, which deposits crystals on cooling; reddens litmus; when heated, undergoes the aqueous fusion, and is converted into *dried alum* (*Alumen Exsiccatum*, U. S.) The alum of commerce generally contains some iron as an impurity.

*Incompatibles.*—The alkalies and their carbonates, lime-water, magnesia and its carbonate, sugar of lead, and tartrate of potassa.

*Uses.*—A powerful astringent, both general and local. When long used, it is apt to injure the organs of digestion. Large doses occasion irritation of the stomach and bowels, and even inflammation. Given internally, in hemorrhages, particularly of the uterus and lungs; also in colica pictonum, where it is supposed to do good by a chemical action; formerly used in intermittents. Its nauseant effect is best obviated by combining it with aromatics and opium.

yed externally, as an astringent to the throat in inflammation;
arrest slight hemorrhages, as in epistaxis, and bleeding from
ites; also as an injection in leucorrhœa and chronic diarrhœa,
a wash to indolent ulcers.
m-*curd* is made by rubbing up alum with the white of an
ised in conjunctivitis.
m-*whey* is made by boiling ʒij of alum in a pint of milk, and
ng; dose, f℥ij.—Dose of powdered alum, 5 to 15 grains,
times a day; in hemorrhages, the dose must be much in-
l. Alum is sometimes used as an *emetic*.
preparations of *copper*, *zinc*, and *silver* are also astringent;
they are also *tonic*, they will be spoken of under the latter

## CLASS II.

### TONICS.

ICS are medicines possessing the power of gradually increasing
ie of the muscular fibre, when relaxed, and the vigour of the
vhen weakened by disease. Muscular power and tonicity are
vays associated; the former may be increased under excite-
where there is actual debility. Though resembling astrin-
in some of their effects, they do not produce corrugation,
when combined with the astringent principle. They resem-
stimulants in the fact of acting on the system through the
n of the nervous system; but they differ from these in the
ss, as well as the permanency of their effects. Tonics increase
*wer*, while mere stimulants only produced increased *action*.
l to excess, they are productive of debility; and if used in a
f health, they act injuriously, causing an excitation, followed
roportionate degree of debility. Tonics are particularly in-
l in functional disorders of the digestive organs, as dyspepsia,
the convalescence from acute disorders. *Bitterness* was at
me supposed to be an essential condition to constitute any
a tonic; and although it is true that nearly, if not quite
vegetable tonics have a bitter taste, still the fact that the
l tonics are not bitter, would serve to prove that bitterness
absolutely indispensable in a tonic medicine.
ics produce their effects either through the nervous system,
he tonicity or nutrition; or by a direct impression upon the

stomach, enabling it to perform the digestive process better, and so to prepare a more nourishing material for the blood.

They may be conveniently arranged under the two orders of Vegetable and Mineral tonics.

### VEGETABLE TONICS.

These may be divided into 1, the Simple or Pure Bitters; 2, Bitters of Peculiar Properties; 3, Stimulant Tonics; 4, Aromatics.

The modification may be caused by some property inherent in the bitter principle, as in the Peruvian bark; or it may be caused by the presence of some stimulating volatile oil, as in serpentaria; or of a sedative principle, as in the case of wild-cherry bark.

### I. SIMPLE BITTERS.

These merely increase the appetite and promote digestion, without increasing the circulation. They are especially useful in dyspepsia and in convalescence.

QUASSIA, U. S.—Wood of the *Quassia amara*, and *Simaruba excelsa*, trees growing in South America and Jamaica. Imported in billets, which are nearly white, very light in texture, no odour, and a pure, intensely bitter taste. Kept in the shops in the form of chips or raspings. Contains a peculiar bitter principle called quassin. Cold water and alcohol extract its virtues.

*Uses.*—A pure bitter tonic; does not excite the system; applicable in simple dyspepsia, and in convalescence from acute disorders. Used in South America in the treatment of remittent fever.

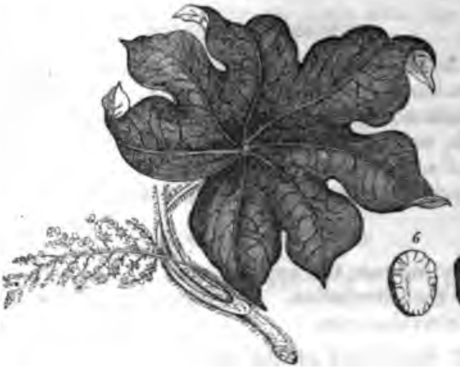
Dose of powder, 20 grains to ʒj; of the infusion (*Infusum Quassiæ*, U. S.), made with ʒij to Oj of cold water, f ʒij; of the extract (*Extractum Quassiæ*, U. S.), gr. ij to gr. v; of the tincture (*Tinctura Quassiæ*, U. S.), fʒj to fʒij.

*Simaruba*,—the bark of the *Simaruba officinalis* possesses properties similar to those of quassia, and may be substituted for it.

COLUMBO.—(*Colomba*, U. S.)—Root of the *Cocculus palmatus* (Fig. 2), a climbing plant, growing in Mozambique. The root is perennial, consisting of a main body and numerous offsets. The root, when dug up by the natives, is sliced transversely, and dried. Found in the shops in circular or oval disks, from half an inch to two inches in diameter, and from a quarter to three quarters of an inch in thickness. The epidermis is wrinkled, and of a brownish colour; beneath this is a yellow cortical portion, and within this, the shrunken, whitish, medullary part. It is liable to be attacked by worms, from the starch which it contains. Odour, slightly aromatic; taste, bitter and mucilaginous. Should not be kept in the state of powder, from its liability to attract moisture. Water and alcohol extract its active properties, which depend on a peculiar principle called *columbin*.

).—A mild and excellent tonic; a good remedy in simple sia, and in convalescence; also in the declining stages of

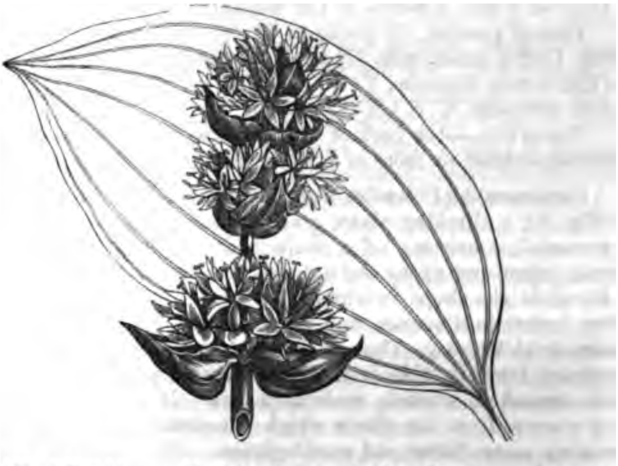
Fig. 2.



ery and diarrhœa. Often given with purgatives and aro-

e of powder, 10 to 20 grains; of the infusion, (*Infusum Co-* U. S.,) made with ℥ss. to Oj of cold water, f℥j to f℥ij; of cture, (*Tinc. Colombæ*, U. S.,) fʒj to f℥ij.

Fig. 8.



TIAN. (*Gentiana*, U. S.)—Root of the *Gentiana lutea*, a ial plant, growing in the mountainous regions of Europe.

It comes in pieces of considerable length, sometimes sliced longitudinally, twisted and much wrinkled externally, and of a reddish-brown colour; yellowish within; of a spongy texture; odour, feeble, and somewhat peculiar; taste, very bitter and sweetish; colour of powder, yellowish. Water and alcohol extract its virtues, which depend chiefly on a peculiar crystalline bitter principle called *gentianin*.

*Prop.*—A pure simple bitter, much employed in dyspepsia, particularly in the form of infusion, made with senna, or rhubarb, and ginger. Its powder is often combined with iron and purgatives. Gentian is slightly stimulant.

Dose of powder, 10 to 40 grains; of the infusion, made with ℥j to Oj of cold or hot water, f℥ij. The compoun dinfusion (*Infusum Gentianæ Compositum*, U. S.), contains orange-peel, coriander seeds, and a little dilute alcohol. The tincture (*Tinctura Gentianæ Composita*, U. S.), contains cardamom seed and orange-peel, and is one of the best of the bitter tinctures; dose fʒj to fʒij. The extract (*Extractum Gentianæ*, U. S.) is used in the dose of 5 to 30 grains.

*White Gentian*—the root of *Gentiana purpurea*—is occasionally seen in the markets.

The *American Columbo* (*Frasera*, U. S.)—root of the *Frasera Walteri*—is an indigenous Gentian, growing west of the Alleghany Mountains. Its properties, &c., resemble those of Gentian.

**Gold Thread.** (*Coptis*, U. S.)—Root of the *Coptis trifolia*, a small, evergreen, herbaceous plant, growing in New England. The plant much resembles a strawberry vine, and has a thin interlaced root, of a golden-yellow colour. In its general properties it strongly resembles quassia; its virtue depends on a bitter extractive. Best given in infusion, made with ℥ss to Oj of water; used sometimes as a wash in aphthous sore mouths.

The *Sabbatia angularis*, or *American centaury* (*Sabbatia*, U. S.), is another excellent indigenous tonic, having properties resembling those of the above-named simple bitters. It is generally used in the form of infusion.

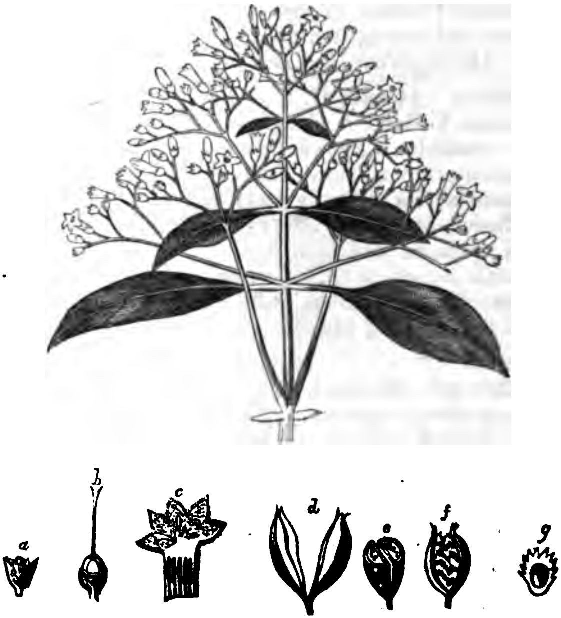
**Thoroughwort—Boneset.** (*Eupatorium*, U. S.)—The herb *Eupatorium perfoliatum*,—an indigenous perennial, growing in moist places, distinguished by the perfoliate character of its leaves, each pair of which are at right angles to those immediately above and below. It has a faint odour, and a strong, bitter taste. Hot water extracts its virtues, which are believed to reside in a bitter principle. The cold infusion acts as a mild, pleasant tonic; the hot infusion as a diaphoretic, or even as an emetic.

### II. BITTERS OF MODIFIED PROPERTIES.

**Peruvian Bark.** (*Cinchona*, U. S.)—The genus *Cinchona* of the former botanists, comprised as many as fifty distinct species;

or Lindley mentions twenty-six species, most of which are own. Of these the most important, as affording most of the commerce, are the *C. Condaminea*, *C. micrantha*, *C. cordi*nd *C. Calisaya*. The genuine cinchona trees are exclusively vithin the geographical limits of La Paz, about 20° of south , and Santa Martha, about 11° of north latitude. They the mountainous regions of the Andes, usually about 6000 ove the level of the sea. The several localities which furnish k are the following, in their order of discovery :—Loxa, Sta. Bogota, Huanuco, La Paz, and Sta. Martha. Of these, Bod Sta. Martha furnish the *Carthagena barks;* the others the *officinal barks*. The name *Cinchona* was given to the from the circumstance that the Countess of Cinchona was f intermittent fever by the use of the bark. It was also *Jesuits' bark* and *Jesuits' powder*, from its having been used Jesuits as a secret remedy. All the different species of the na have their own peculiar botanical characteristics: they

Fig. 4:



le each other, however, in their general features: thus they e opposite leaves, set upon short petioles; the flowers are at the extremities of the branches, and of a white or rose colour. Fig. 4 represents a branch of the *C. Condaminea.*

There are only three varieties of genuine Peruvian bark recognised by the pharmacopœias; these are the *pale*, the *yellow*, and the *red*.

*Pale Bark* (*Cinchona pallida*, U. S.)—Called also *Loxa* or *Crown bark*, and by the French, *gray bark*. It includes the commercial varieties of *Loxa*, and *Lima* or *Huanuco* barks; and is the product of the *C. Condaminea*, and the *C. micrantha*. It comes only in quills, which are from half a foot to a foot long, from two lines to an inch in diameter; the epidermis is marked by numerous transverse cracks; colour of epidermis, gray, though often diversified; internal colour, cinnamon; fracture, smooth; colour of powder, lighter than the others; taste, bitter and astringent, but less bitter than the others.

*Yellow Bark* (*Cinchona flava*, U. S.)—Called also *royal yellow* and *Calisaya* bark. The species which yields it has been ascertained by Widdel to be the *C. Calisaya*. It comes in quills and flat pieces; the former are from three inches to a foot in length, and from a quarter of an inch to two inches in diameter; epidermis, brownish, marked by longitudinal wrinkles and transverse fissures; epidermis often wanting; texture fibrous; fracture splintery, exhibiting minute spiculæ; colour of bark, yellow-orange; taste, bitter and nauseous; odour, tan-like; relative value superior to the others, as it abounds most in quinia.

*Red Bark* (*Cinchona rubra*, U. S.).—Supposed to be derived from the larger branches and trunk of the same tree which yields the pale bark; size of quills, half an inch to two inches in diameter, and two to twelve inches long; flat pieces are large and thick; external colour reddish-brown, with a very rough epidermis, which occasionally exhibits warts upon it; colour of powder, reddish; taste, very bitter.

The *pale bark* contains most cinchonia, the *yellow* most quinia, and the *red* about an equal portion of both alkalies.

The varieties of bark called *Carthagena barks* are much inferior to those just described. They are all shipped from the northern or Atlantic ports of South America.

Cinchona yields its virtues to water and alcohol. Its active principles are two alkalies named *quinia* and *cinchonia*, which exist combined with *kinic acid*. It also contains *cinchonic red*, *cinchonic yellow*, *tannic acid*, *gum*, &c.

*Quinia* is prepared by macerating Calisaya bark in water, acidulated with muriatic acid; this acid forms the soluble muriate of quinia; filter, and add lime, which throws down the quinia, chloride of calcium remaining in solution; next add boiling alcohol, which takes up the quinia, which may then be decolorized by animal char-

ıd separated by evaporation. It occurs in a white flocculent
; nearly insoluble in water; very soluble in boiling alcohol,
ınd volatile oils; unites with acids to form salts, of which
st important is the officinal *sulphate*.
*homia* is a white crystalline substance, with general properties
ling those of quinia.
*npatibles.*—The alkalies, alkaline earths, acetate of lead, and
acid.
*iological effects.*—A tonic in small doses, and also anti-
; the latter is peculiar, and is not dependent upon its tonic
ies. In full doses, apt to occasion oppression of stomach,
and purging; it also acts upon the cerebro-spinal system; as
l by the tension of the head, ringing of the ears, and occa-
leafness.
.—As a mere tonic, it is inferior to the simple bitters in dys-
but applicable in exhausting stages of disease, particularly
purations, also in typhoid complaints, in neuralgia, and in
ıtism. Its most important use is in intermittent diseases,
lly intermittent and remittent fever; believed to do good in
ffections through the agency of the nervous system.
hona is given in powder, infusion, decoction, tincture, and
. Most powerful in substance, but apt to disagree with the
h, and offensive on account of its bulk; dose ʒj, repeated so
ive ℥j to ℥ij in the intermission; its efficacy is increased by
ing it with serpentaria. Powdered bark sometimes used ex-
y, in the form of quilted jackets—applied to children. Dose
*infusion* (*Infusum Cinchonæ Flavæ*, U. S.), (℥j to Oj boiling
f℥ij. Dose of the *decoction* (*Decoctum Cinchonæ Flavæ*,
the same. The cold infusion (*Infus. Cinch. Compos.*, U. S.),
erable, made with cold water, acidulated with sulphuric acid,
more completely exhausts the virtues of the bark, and gives
infusion. Dose of *tincture* (*Tinctura Cinchonæ*, U. S.), fʒj
. *Huxam's tincture* (*Tinct. Cinch. Composita*, U. S.), con-
lso serpentaria and other ingredients; dose, the same. Dose
act, 10 to 30 grs.
*hate of Quinia.*—Chemically a *disulphate;* made by adding
sulphuric acid to quinia, and crystallizing. Occurs in light,
y, white crystals, without odour; taste bitter; soluble in
water and alcohol, and the dilute acids; cold water freely
es it by the aid of sulphuric acid; colour of the solution,
ent. It is apt to be adulterated, which may be detected if
mineral substance, as sulphate of lime, by a residue being
exposing it to a high heat; gum, by its greater solubility;
by iodine, &c.
*ts on System.*—Generally similar to those of the bark, but
nes fails to cure intermittents, when the bark will succeed.

Dose, 10 to 14 grs., equivalent to ℥j of good bark; ordinary dose, one to three grains; may be often given by enema; also endermically.

Dose of the *impure sulphate of quinia*, or *quinoidine* (made by evaporating the mother waters), double that of the sulphate. Dose of *sulphate of cinchonia*, the same as that of sulphate of quinia.

The best substitutes for Peruvian bark are the *salix*, or willow, which contains a bitter principle, called *salicin*; the barks of the *Swietenia febrifuga*, the *Horsechestnut*, and the *Dogwood*; the latter contains a peculiar bitter principle, named *cornine*. Also, the *Liriodendron Tulipifera*, U. S., or *American Tulip-Tree*.

Wild Cherry Bark. (*Prunus Virginiana*, U. S.)—Bark of the *Cerasus Serotina*, an indigenous tree. The bark is taken both from the stem and root; comes in pieces several inches long, slightly curved, usually deprived of the epidermis; has a cinnamon colour; taste, bitter and aromatic, with the flavour of the bitter almond; odour, similar; active properties to water and alcohol; injured by heat. Active principles, hydrocyanic acid and a volatile oil; these do not pre-exist in the plant, but are the result of a reaction between the *amygdaline* and *emulsine* with water.

*Effects.*—A tonic to the digestive organs, and at the same time sedative to the system. Useful in convalescence, attended with irritability of the stomach; also in the hectic of phthisis.

Best given in *cold infusion* (*Infusum Pruni Virginianæ*, U. S.), made by macerating half an ounce in a pint of cold water 24 hours, or by displacement; dose, f℥ij three times a day. There is also a *syrup* (*Syrupus Pruni Virginianæ*, U. S.), which is an excellent preparation; dose, f℥j–iv.

## STIMULANT TONICS.

These tonics are more stimulating to the system than the foregoing. They owe their stimulating properties to a volatile oil.

Virginia Snake Root. (*Serpentaria*, U. S.)—Root of the *Aristolochia serpentaria*, an indigenous herbaceous plant, growing in rich woods. The root is perennial, consisting of numerous long slender fibres, proceeding from a common caudex. As found in the shops, it is in tufts of a brownish colour; has a strong camphorous odour, and a very bitter, acrid, camphorous taste. It yields its virtues to alcohol and water; active ingredients, a volatile oil and a bitter principle.

*Effects.*—A stimulant tonic; used in low forms of disease; also, stimulates the secretions; employed sometimes as an adjuvant to Peruvian bark.

Dose of powder, 10 to 30 grs.; of the infusion (*Infusum Serpentariæ*, U. S.), (made with ℥ss to Oj water) f℥j to f℥ij; of the

(*Tinctura Serpentariæ*, U. S.), f℥j to f℥ij. The decoction
tract are objectionable.

MOMILE. (*Anthemis*, U. S.)—Flowers of the *Anthemis no-*
small, herbaceous perennial, indigenous to Europe, but in-
d into the United States. The flowers are both double and
the latter said to be the strongest. Imported usually from
d. They are about half an inch in diameter, nearly spheri-
a yellowish-white colour; odour, fragrant and aromatic;
arm, aromatic, and bitter; virtues depend on a volative oil
ter extractive, which are imparted to water and alcohol.
.—A mild, stimulant tonic; useful in convalescence and
rms of dyspepsia; the warm infusion acts as a diaphoretic
etic. Dose of *cold infusion* (℥ss to Oj), as a tonic, f℥ij.
e are several other herbaceous plants, which are mildly stimu-
d tonic to the system, as Wormwood (*Absinthium*), Tansey
*ctum*), Horehound (*Marrubium*). These all contain a volatile
a bitter principle.

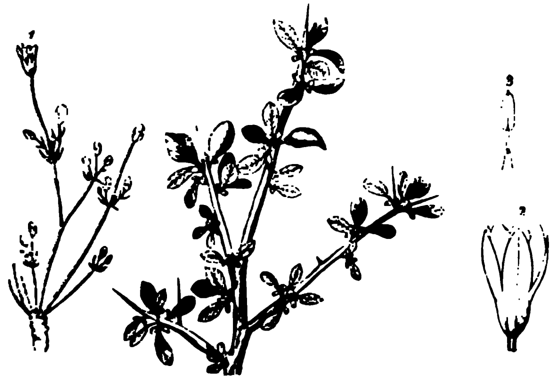
ARILLA BARK. (*Cascarilla*, U. S.)—Bark of the *Croton*
*ria*, and of the *Croton cascarilla*, trees growing in the West
; chiefly imported from Eleutheria, one of the Bahamas;
in small-sized quills, and in small chips; epidermis is par-
letached. Odour aromatic; when thrown upon hot coals it
an agreeable odour like musk; taste, bitter and aromatic.
hiefly as an adjuvant to other tonics. Active ingredients, a
oil, and bitter extractive. Dose of powder, 20 to 30 grs.;
infusion (*Infusum Cascarillæ*, U. S.), made in proportion of
j, f℥ij.

USTURA BARK. (*Angustura*, U. S.)—Bark of the *Galipea*
*lis*, and probably of *G. Cusparia*, a small tree growing in
America. It comes in pieces slightly curved, about a line in
ss, and bevelled at the edges. Colour, yellowish-gray;
itter and aromatic. Virtues depend upon a volatile oil and
xtractive. A stimulant tonic, not much employed at present;
be carefully distinguished from the *false Angustura bark*,
is derived from the Nux Vomica, and is very poisonous. The
rk is always bevelled at the edges, and softens and becomes
like leather on being soaked in water. The false variety is
ly bitter to the taste, and gives a red colour when touched
itric acid, from the *brucia* which it contains. Dose of the
, 10 to 20 grs.; of the *infusion* (*Infusum Angusturæ*, U. S.),

RH. (*Myrrha*, U. S.)—An exudation from the *Balsamoden-*
*yrrha*, a shrub, or small tree, growing in Arabia and Abys-
The juice exudes spontaneously, or by incision. Two
rcial varieties—*India* and *Turkey* myrrh: the latter is the

finest; comes in masses and tears; of a pale reddish-yellow colour, semi-transparent and brittle; of an aromatic peculiar odour. India myrrh is much inferior,—darker, softer, and much mixed with a substance called *bdellium.* Myrrh is usually imported from Bombay. It is a gum-resin, associated with a volatile oil; forms a clear tincture with alcohol, and with water a yellow opaque emulsion.

Fig. 5.



The alkalies have the property of uniting with myrrh, and rendering it more soluble in water. Its active properties reside chiefly in the resin.

*Effects.*—A stimulant tonic, with a tendency at the same time to the lungs and uterus. Most employed in chronic pectoral affections, and in amenorrhœa. Dose of powder, 10 to 30 grains; of the tincture, fʒss to fʒj. The *tinctura* (*Tinctura Myrrhæ*, U. S.) is most used as an external application to spongy gums, and to indolent ulcers.

### AROMATIC TONICS.

*Aromatics* are substances possessing an agreeable penetrating odour, and a warm, pleasant taste. These properties depend upon a *volatile oil,* which may be generally separated by distillation with water.

The *volatile oils* (*essential* or *distilled oils*) have the odour and taste of the substances from which they are procured; sp. gr. generally less than that of water; almost insoluble in water; soluble in alcohol, ether, and the fixed oils. Their *proximate* composition is into two principles, *stearoptine* and *eleoptine*; the former is solid, the latter liquid. If adulterated with a fixed oil, the fraud may be detected by their leaving a permanent greasy stain upon paper.

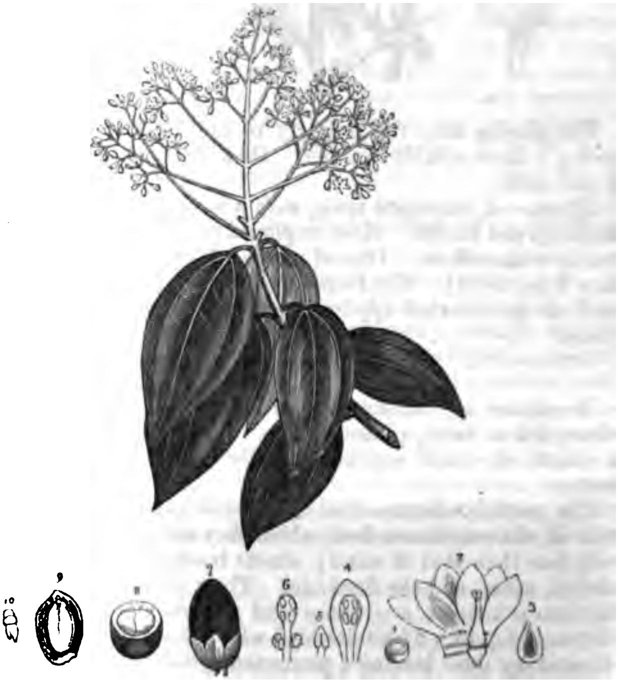
the aromatics possess stimulant properties, though in diffe-
egrees. They include the *spices*, which, on account of their
ble odour and taste, are much employed as condiments, and
r flavouring or disguising less pleasant medicines. As medi-
they act as grateful stimuli; creating warmth of stomach,
ing nausea, expelling flatulence, and relieving slight colic.

ɪNGE PEEL. (*Aurantii Cortex*, U. S.)—The outer rind of the
(*Citrus aurantium*, or *C. vulgaris*). There are two varieties
ıge—the *sweet*, and the *bitter* or *Seville orange;* the rind of
tter only is tonic. As usually prepared by simply peeling
ıit and drying, it is apt to become mouldy; the inner portion
. be first rejected. The bitter variety contains a bitter extrac-
nd volatile oil. It is a mild aromatic, chiefly used for fla-
g.

*confection* (*Confectio Aurantii Corticis*, U. S.) is chiefly em-
as a vehicle.

NAMON. (*Cinnamomum*, U. S.)—Bark of the ***Cinnamomum***

Fig. 6.



*zeylanicum* (Fig. 6), a native of Ceylon. The bark is stripped from trees of six or seven years old. When dried, it curls up laterally, so as to form quills, which are inserted one within another. The variety called *Cassia* is believed to be the product of the *C. aromaticum*, a native of China, and is sent from Canton.

True cinnamon is known by its colour, the thinness of its bark, the congeries of quills in which it always comes, its splintery fracture, and its sweetish aromatic taste, more pleasant than that of cassia bark, though the best specimens of the latter may be considered nearly as good. There is a volatile oil of cinnamon, and also one of cassia. Cinnamon contains some tannic acid, which is the cause of its astringency.—It is chiefly used as an adjuvant.

*Cinnamon Water* (*Aqua Cinnamomi*, U. S.), is made by rubbing up the oil of cinnamon with carbonate of magnesia, and then adding water: it is used as a vehicle for other medicines. The *compound tincture* (*Tinctura Cinnamomi Composita*, U. S.), containing also cardamom, caraway, raisins, and cochineal, is used in the dose of f ʒj to f ʒij.

*Pulvis Aromaticus*, U. S. (*Aromatic Powder.*)—Contains cinnamon, cardamom, ginger, and nutmeg. It is stimulant and carminative; used chiefly as an adjuvant.

**Canella**, U. S.—Bark of the *Canella alba*, a tree growing in the West Indies; comes in imperfect quills, of a yellowish-white colour, and a bitter aromatic taste. Its properties are those of a stimulant tonic and aromatic. Not much employed alone; an ingredient in the *hiera picra*, or *Pulvis Aloes et Canellæ.*

The other spices most employed are *Nutmeg*, *Cloves*, *Mace*, *Black Pepper*, *Cubebs*, and *Allspice*.

**Nutmeg.** (*Myristica*, U. S.)—Fruit of the *Myristica moschata*, a native of the Malaccas, but grown in Cayenne. They are the kernels of the nut, which is surrounded by a membrane, called *mace*. Nutmegs contain a volatile oil (*Oleum Myristicæ*, U. S.), procured by distillation, and a fixed oil, called *oil of mace*, obtained by expression. Nutmegs are aromatic, and, in large doses, narcotic. Used chiefly as a condiment, and to flavour farinaceous drinks. Mace is employed for the same purpose.

**Cloves.** (*Caryophyllus*, U. S.)—Unexpanded flowers of the *Eugenia caryophyllata*, an evergreen, native of the Malaccas. They ought to have a deep brown colour, and an oily aspect.

Cloves are one of the most stimulant aromatics; they depend for their virtue upon a volatile oil (*Oleum Caryophylli*, U. S.), which is rather heavier than water. Dose of powder, 5 to 10 grains; of *infusion* (*Infusum Caryophilli*, U. S.), made with ʒij to the pint, f℥ij; of the volatile oil, 2 or 3 drops.

**Black Pepper.** (*Piper*, U. S.)—Dried berries of the *Piper*

, a vine, native of the East Indies. The fruit when first
red, but becomes black by drying. When deprived of its
oating it constitutes *white pepper*. It contains a peculiar
ine principle—*piperin*—which, however, is not the active
le; this resides in the volatile oil. Piperin has been used
lvantage as an *anti-intermittent*; dose, gr. ij–viij. The fluid
(*Extractum Piperis Fluidum*, U. S.), has been lately intro-
dose, f ʒss–j.

k pepper is chiefly employed as a condiment; it is a decided
nt in large doses. Its excessive use is injurious to the
h.

EBS. (*Cubeba*, U. S.)—Dried fruit of the *Piper cubeba*, a
uch resembling the last. The cubeb berries are distin-
l by being reticulated, and having a short footstalk attached
ı. They have an aromatic odour, and a warm camphorous
depend for their virtues on a volatile oil, procured by distil-
They have a tendency to act on the kidneys, and in larger
ies to affect the head. As a medicine, its chief use is in
ns of the urino-genital organs, particularly gonorrhœa. Dose
ler, ʒss to ʒj; of the volatile oil (*Oleum cubebæ*, U. S.), 10
ops. The *fluid extract* (*Extractum Cubebæ Fluidum*, U. S.)
excellent preparation; dose, gtt. xx to f ʒj. The *tincture*
*ra Cubebæ*, U. S.) is given in the dose of f ʒss–j.

SPICE. (*Pimenta*, U. S.)—Called also *Jamaica pepper*. Grows
aica; fruit of the *Myrtus pimenta*; called *allspice*, from its
ing the flavour of several other spices. Its virtues depend
latile oil. Used only as a condiment.

AROMATIC SEEDS most employed in medicine are the follow-

DAMOMS (*Cardamomum*, U. S.), from the *Elettaria Carda-*
*n*, a native of Malabar and the East Indies.

NEL SEED (*Fœniculum*, U. S.), from the *Fœniculum vulgare*,
e of the south of Europe, but introduced here.

ANDER (*Coriandrum*, U. S.), from *Coriandrum sativum*,
e of Europe, but cultivated here.

AWAY (*Carum*, U. S.), from *Carum Carui*, growing in
.

SE (*Anisum*, U. S.), from *Pimpinella Anisum*, a native of
and Africa.

e all contain a volatile oil. They are used, as well as their
iefly as adjuvants, to impart an agreeable flavour to other
ies. The *tincture of Cardamoms* (*Tinctura Cardamomi*,
is an excellent stomachic aromatic for nausea and slight
lose, f ʒj–ij.

*Fennel Water* (*Aqua Fœniculi*) is much used as an agreeable vehicle for mixtures.

The following AROMATIC HERBS (*Labiatæ*) are also employed in medicine:

LAVENDER. (*Lavandula*, U. S.)—The flowering tops of *Lavandula vera*, native of Europe, but grown here. The flowers have a delightful odour, and yield a volatile oil on distillation. The *spirit*, or *lavender-water*, as it is often improperly named (*Spiritus Lavandulæ*, U. S.), is made by distilling the flowers with alcohol; it is a very agreeable perfume. The *compound spirit*, or *lavender compound* (*Spiritus Lavandulæ Compositus*, U. S.), contains spirit of lavender, spirit of rosemary, cinnamon, cloves, nutmeg, and red saunders. It is much employed as a grateful stomachic in sick stomach and mild colics; also to impart flavour; dose fʒj–ij.

ROSEMARY. (*Rosmarinus*, U. S.)—The flowering tops of *Rosmarinus officinalis*; indigenous in Europe, but grown here. It contains a highly stimulating volatile oil, used in making opodeldoc, and camphorated tincture of soap. The *spirit* (*Spiritus Rosmarini*, U. S.) is used occasionally.

PEPPERMINT. (*Mentha Piperita*, U. S.)—A native of Europe, but naturalized here. The whole herb is used, and is most active when in flower. Its *oil* is occasionally prescribed in doses of gtt. ij–iij, but is more frequently used in the form of *Essence of Peppermint* (*Tinctura Olei Menthæ Piperitæ*, U. S.), made by dissolving f℥ij of the oil in Oj of alcohol. Dose, gtt. v–xx, on a piece of loaf-sugar, to relieve nausea and slight colic. *Peppermint-water* (*Aqua Menthæ Piperitæ*, U. S.), is prepared by rubbing up fʒss of the oil with ʒj of carbonate of magnesia, and then adding Oij of distilled water, and filtering. It is much used as a vehicle. The fresh herb bruised and applied to the stomach will frequently relieve pain and nausea; it is used chiefly for children.

SPEARMINT. (*Mentha Viridis*, U. S.)—Is very similar in properties to Peppermint. The *oil*, *essence*, and *water* are made in the same manner as the corresponding preparations of Peppermint, and are used for similar purposes.

PENNYROYAL (*Hedeoma*) is similar to the Mints in properties, though rather more stimulating.

BALM (*Melissa*, U. S.), and MARJORAM (*Origanum*, U. S.), are also strongly allied in properties to the preceding herbs.

SAGE. (*Salvia*, U. S.)—Leaves of *Salvia officinalis*. Contains a volatile oil and some tannic acid, which imparts to it astringent properties. It is chiefly employed in infusion (*sage-tea*) for sore throats. Alum may often advantageously be added.

PARTRIDGE-BERRY. (*Gaultheria*, U. S.)—Leaves of *Gaultheria*

*bens.* It contains a very heavy essential oil, of a dark
used to impart flavour; an ingredient in the compound syrup
aparilla.

ER. (*Zingiber*, U. S.)—Rhizoma of *Zingiber officinale*, a
ial, herbaceous plant, growing in the East and West Indies.
varieties are found in the shops. Sometimes the recent
a state of vegetation, is sent to the market, constituting
*inger;* sometimes the root is dug up, scalded to prevent
ation, and then dried, constituting common *black ginger;*
the best pieces are selected, the outer skin removed, so as to
a white appearance, and imported as *white ginger*. The latter
from Jamaica.

ur of the powder, light yellowish-white; odour, powerful and
r; taste, strong, aromatic, and biting. It contains a volatile
acrid resin and starch.

a grateful stimulant and carminative; used to expel flatus
he bowels; employed also as an adjuvant to the bitter tonics,
s of dyspepsia. It is apt to be much deteriorated by age.
n in powder, infusion, tincture, and syrup. Dose of powder,
30 grs.; of the infusion (*Infusum Zingiberis*, U. S.), made
℥ss to the pint, f℥ij; of the tincture (*Tinctura Zingiberis*,
fʒj. The *syrup* (*Syrupus Zingiberis*, U. S.) is used gene-
r flavouring. Externally applied, ginger acts as a rubefacient.

ET FLAG. (*Calamus*, U. S.)—Rhizoma of *Acorus calamus*,
t growing in marshes. Its effects on the system, and uses
ry similar to those of ginger. It contains a volatile oil and
tive.

## MINERAL TONICS.

N. (*Ferrum*, U. S.)—The most important of all the mineral
; a constituent of many organized beings, and found in the
bules of the blood. The preparations of iron, called *chaly-*
combine tonic with astringent properties; they increase the
e, promote digestion, and exalt the general functions of life.
its use, the red corpuscles of the blood become much in-
l, giving rise to a tendency to plethora. Its influence over
rvous system appears to be rather secondary. The chaly-
prove most useful in dyspepsia with constipation, not accom-
by inflammation of the stomach; also in chronic debility of
s associated with amenorrhœa; in some nervous affections;
pecially in anemia.

allic iron is probably inert upon the system; but when swal-
in that state, it is apt to become converted into on oxide or
the stomach and bowels, and to disengage hydrogen gas,
causes unpleasant eructations. Iron filings (*Ramenta Ferri*,

U. S.), which are sometimes used, should be previously purified by means of a magnet. Dose, gr. v–xx.

*Squamæ Ferri* (*Scales of Iron*).—Obtained by hammering red-hot iron; consist chemically of the protoxide and peroxide. Dose, 5 to 20 grains.

*Ferri Pulvis*, U. S. (*Iron by Hydrogen*.)—Made by passing hydrogen over the oxide heated to redness it is an efficient preparation. Dose, gr. j–v.

*Rubigo Ferri* (*Rust of Iron*).—Formerly called prepared carbonate of iron; prepared by exposing fine iron wire to air and moisture, then reducing to a fine powder by levigation and elutriation. It consists of the protocarbonate and the sesquioxide. Colour, red; taste, styptic; insoluble in water. Dose, gr. v–xx.

*Ferri Subcarbonas*, U. S. (*Subcarbonate of Iron*).—Formerly named *Precipitated Carbonate*; made by mixing together the solution of the carbonate of soda, and sulphate of iron. When first prepared the colour is greenish-black, which soon changes into a brownish-red, from the absorption of oxygen; it then consists chiefly of the sesquioxide. It has a styptic taste; no odour; is insoluble in pure water. It is one of the best chalybeates; is well borne by the stomach, and no danger from an over-dose; much used in neuralgia. Dose, 5 to 30 grains.

*Pilulæ Ferri Carbonatis*, U. S. (*Vallet's Ferruginous Pills.*)—Prepared as the subcarbonate, with the addition of honey, which prevents the absorption of oxygen; colour, bluish. Dose, 2 to 10 grains, three times a day.

*Mistura Ferri Composita*, U. S. (made to imitate *Griffith's Antihectic Mixture*.)—Prepared by mixing together solutions of carbonate of potash and sulphate of iron, with myrrh and spirits of lavender. Used chiefly in amenorrhœa with dyspepsia.

*Ferri Sulphas*, U. S. (*Sulphate of Iron—Green Vitriol*, or *Copperas*.)—Prepared by action of dilute sulphuric acid on pure iron wire. Colour, pale green; crystals efflorescent, soluble; taste, styptic; fuses when heated. *Incompatibles*—alkalies, alkaline earths, and earths with their carbonates, and those soluble salts whose acids form soluble salts with iron, and whose bases form insoluble sulphates; also tannin. It is one of the most astringent of the chalybeates, also the most irritant. Applicable when small doses are required; best in pill of the effloresced salt. Dose of the crystallized, 1 to 5 grains; of the dried, gr. ss. to grs. ij.

*Tinctura Ferri Chloridi*, U. S. (*Muriated Tincture of Iron*.)—Made by the action of muriatic acid on the subcarbonate, and then adding alcohol. Colour, reddish-brown; odour, ethereal; taste, sour and styptic. Used in affections of the urino-genital organs. An excellent chalybeate. Dose, gtt. v–xx. Used externally as a stimulant *i et Potassæ Tartras,* U. S. (*Tartrate of Iron and ι.*)—Prepared by adding cream of tartar in water to the ·prepared hydrated oxide of iron at the temperature of 140°; vaporate to the consistence of syrup, and then spread upon r porcelain, so as to dry in the form of scales. *Prop.*—In rent scales of a ruby-red colour, wholly soluble in water; is of the old *wines of iron.* It is an admirable chalybeate: r. x–xx.

*i Phosphas,* U. S. (*Phosphate of Iron.*)—Prepared by the of phosphate of soda on sulphate of iron. It is insoluble in of a bluish colour, and changes by exposure. Dose, gr.

*i Ferrocyanuretum,* U. S. (*Ferrocyanuret of Iron, Prus- lue.*)—Prepared by the action of the persulphate of iron on anuret of potassium. It is of a deep blue colour, and insolu- t is tonic and sedative. Used in nervous affections, and in ittents. Dose, gr. v–xx.

*i Oxidum Hydratum,* U. S. (*Hydrated (sesqui) Oxide of* —Prepared by the action of solution of ammonia on the solu- the per (sesqui) sulphate of iron (made by adding sulphuric ric acids to a solution of the sulphate,) and washing the pre- with water. It should be kept in close bottles under water. Chiefly as the antidote for arsenic, in which case it must be in large doses. Its remedial effects are similar to those of bonates.

*um Ammoniatum,* U. S. (*Ammoniated Iron.*)—Prepared by muriatic acid to subcarbonate of iron, and then add muriate nonia, and evaporate to dryness. It is of an orange colour, in water. Used chiefly in nervous disorders. Dose, gr.

*i Iodidum,* U. S. (*Iodide of Iron.*)—Prepared by putting and iron filings together in water, in a glass or porcelain ves- l gently heating; then filter and evaporate. As it is ex- deliquescent, it is better to employ the solution (*Liquor odidi,* U. S.), made by the addition of sugar and water; the reventing its decomposition. *Prop.*—An excellent prepara- scrofula and the cachexiæ. Dose, gr. i–ij; of the *solution,* xx.

*i Citras,* U. S. (*Citrate of Iron.*)—Made by adding citric solution to the solution of the hydrated oxide, and then treat cted for tartrate of iron and potassa. It occurs in garnet- es, soluble in water. It is a mild, though certain chalybeate. r. iij–v.

*or Ferri Nitratis,* U. S. (*Solution of Nitrate (sesquini- f Iron.*)—Prepared by the action of dilute nitric acid on iron wire. It is the most astringent of the chalybeates, and is used in chronic diarrhœas. Dose, gtt. x–xx.

The *Lactate* is also occasionally used.

**Copper.** (*Cuprum*, U. S.)—Though probably inert in the metallic state, yet being easily acted upon by the acids of the stomach, it may prove poisonous when swallowed in that state. Poisoning may also result from eating articles cooked in copper vessels. The preparations of copper act as tonics in very small doses, with an especial tendency to the nervous system. Larger doses occasion irritation and inflammation of the stomach. As *poisons*, they act both as local irritants and also upon the nervous centres. The best antidote for metallic copper is an antacid, as magnesia; for the *salts*, the best antidote is albumen.

*Cupri Sulphas*, U. S. (*Sulphate of Copper—Blue Vitriol.*)—Prepared by the action of sulphuric acid on metallic copper. Occurs in large, prismatic, blue crystals; efflorescent on exposure; soluble in water; taste, very styptic; fuses when heated; incompatibles, the same as of iron.

*Effects on System.*—Small doses are astringent and tonic; larger doses vomit; still larger are poisonous. The best antidote is albumen.

Used as a tonic in obstinate ague, and in chronic dysentery and diarrhœa; also, in epilepsy, chorea, and hysteria. Dose, ¼ grain, two or three times a day. Useful as an external application, in solution, to spongy granulations of ulcers, and inflamed conditions of mucous membranes, particularly of the eye.

*Cuprum Ammoniatum*, U. S. (*Ammoniated Copper.*)—Made by rubbing up carbonate of ammonia with sulphate of copper; colour, dark blue. Supposed to have a special tendency to the nervous system; hence used in epilepsia, chorea, &c. Dose, gr. ss–iij, twice a day.

**Zinc.** (*Zincum*, U. S.)—Its preparations are useful in nervous disorders.

*Zinci. Sulphas*, U. S. (*Sulphate of Zinc—White Vitriol.*)—Made by action of dilute sulphuric acid on metallic zinc. Crystals, needle-shaped prisms, white; taste, styptic; soluble in water. Incompatibles, the same as for sulphate of copper.

*Effects.*—Tonic and astringent; used chiefly in chorea and epilepsy. Dose, two to three grains. The *solution* an excellent application to inflamed mucous membranes; strength of the solution gr. j or grs. ij to f℥j of water. It is sometimes employed in combination with the acetate of lead.

*Zinci Acetas*, U. S. (*Acetate of Zinc.*)—Made by adding metallic zinc to a solution of acetate of lead. It is in white crystals, soluble in water; *used*, chiefly externally, as the sulphate.

*i Oxidum*, U. S. (*Oxide of Zinc.*)—Prepared by heating cipitated carbonate. Not much used internally; sometimes lly as an ointment. The *impure oxide*, or *tutty*, is also used form of an ointment for excoriated surfaces.

*mina Præparata*, U. S. (*Prepared Calamine—Native ate of Zinc.*)—Used in the form of a cerate (*Turner's cerate*) d application to excoriated surfaces and certain cutaneous ns.

*hate of Cadmium* has been lately introduced as an external tion for the eye.

ER. (*Argentum*, U. S.)—ARGENTI NITRAS, U. S. (*Nitrate of —Lunar Caustic.*)—Prepared by the action of nitric acid on evaporating, fusing, and running into moulds. Colour, white; very soluble; taste styptic and harsh. Incompatibles, ıe as for iron,—also common salt.

*ts.*—Small doses are tonic; larger, corrosive and poisonous. ıtidote is common salt. Its long use is apt to occasion a dis- on of the skin. Most used in epilepsy and chorea; also in e conditions of the stomach. Dose, gr. ss to gr. ij, given in Its solution is very valuable as a topical application to in- ulcers, and to inflamed mucous membranes, as of the eye, rethra, vagina, and rectum; strength of the solution from gr. r. x to f℥j of distilled water;—also for the throat and tonsils, applied in strong solution, or in the solid form.

*nti Oxidum*, U. S. (*Oxide of Silver.*)—Is made by action of on the nitrate; *used* as the nitrate.

IUTH, (*Bismuthum*, U. S.)—BISMUTHI SUBNITRAS, U. S. *trate of Bismuth—Magistery of Bismuth.*)—Made by the of nitric acid on bismuth, and then throwing the resulting into water, which throws down the subnitrate. A white , without taste or smell. Used chiefly in disorders of the h, connected with diseased innervation, as gastrodynia. Dose, o ten grains. Apt to blacken the stools.

## THE MINERAL ACIDS.

ılly classed among the tonics.

ƆUM SULPHURICUM, U. S. (*Sulphuric Acid.*)—Employed medicine in a state of solution. Acts as a tonic, astringent, rigerant; used in low forms of fever, and to check excessive ation. The dilute acid of the Phar. contains f℥j of the con- ed acid, to f℥xiij of water; dose, 10 to 30 drops, in a wine- f water. The *elixir vitriol*, or aromatic sulphuric acid (*Aci- ulphuricum Aromaticum*, U. S.), contains ginger and cinnamon; it is much used in the hectic fever of phthisis, and in convalescence from acute disorders. Dose, the same.

There is also an *ointment.*

Acidum Nitricum, U. S. (*Nitric Acid.*)—Is tonic and refrigerant; never used in its pure state; two kinds kept in the shops, the *nitric*, which is colourless, and the *nitrous*, which is reddish. Used as a tonic in low forms of fever. Dose, 2 to 10 drops, according to its strength. A strong solution is used externally to indolent ulcers. *Hope's mixture* consists of nitric acid, laudanum, and camphor water; used in dysentery, &c.

Acidum Muriaticum, U. S. (*Muriatic Acid.*)—Colourless when pure; used in a dilute form in low forms of fever, especially in typhus fever. Dose, 5 to 20 drops, in a wineglass of water. Used also as a gargle in scarlet fever.

Acidum Nitro-Muriaticum, U. S. (*Nitro-Muriatic Acid.*)—Made by mixing one part of nitric with two of muriatic acid; mutual decomposition ensues, by which nitrous acid fumes are given off, and chlorine remains dissolved in water. It is thought to have an especial tendency to the liver, and is given in hepatic diseases; also in secondary syphilis. Used likewise as a bath, or foot-bath, in these disorders.—The *solution of chlorine* sometimes used in bronchitis; also the vapour of chlorine inhaled, but is apt to occasion irritation.

Under the head of Tonics, *Cod-liver Oil* (*Oleum Morrhuæ*, U. S.) may be appropriately placed. It is procured from the fresh liver of the codfish, *Gadus Morrhua*, by pressure, or by spontaneous draining. Two or three varieties are found in the markets, the best of which is of a light-yellow colour, and transparent, and of a peculiar taste and smell. It contains some iodine and bromine, besides the usual fatty principles.

*Effects, &c.*—When used for some time it increases the function of nutrition; its influence is especially observable in chronic diseases of a wasting character, particularly in phthisis; given in the forming stage of the latter disorder, it has appeared in many cases to have arrested it. It is unfortunately liable to disorder the stomach. Dose f℥ss–j, two or three times a day. It is necessary to continue its use for two or three months.

# CLASS III.

## ARTERIAL STIMULANTS.

SE are substances which increase the activity of the circula-
ı a primary effect, though their operation is also generally
ɜd to other parts of the system. They are sometimes named
*ts*, and, from their rapidity of action, *diffusible stimulants.*
)ther articles, classed elsewhere, produce, among their other
stimulation of the heart and arteries, as opium, alcohol,
&c. They differ from *tonics* in their more powerful and rapid
they do not, as tonics, increase the *power* of the system.
*r* are indicated in all cases of sudden or great prostration;
:y should not be indiscriminately used, from fear of subse-
reaction. As a general rule, inflammation or fever contrain-
their use; but there may be cases in which they will be

BONATE OF AMMONIA. (*Ammoniæ Carbonas*, U. S.)—Chemi-
*sesquicarbonate;* improperly termed *volatile alkali.* Pre-
by subliming together carbonate of lime and sal ammo-
When first made it is a solid, white, transparent cake;
strong and pungent; taste, acrid and alkaline; soluble in
and alcohol; efflorescent on exposure, losing its stimulant
ies.

*ts.*—A powerful diffusible stimulant, acting chiefly upon the
:ion; has a local tendency to the lungs and skin.

—Much employed in the sinking stages of fever, or of acute
s; also in atonic gout, and dyspepsia attended with acidity of
h; externally, to bites of poisonous insects. Dose, 5 grains
our or two, given in solution with gum and sugar, to obtund
mony.

*Aromatic Spirit of Ammonia* (*Spiritus Ammoniæ Aroma-*
J. S.), is made by distilling together muriate of ammonia,
ıte of potassa, cloves, cinnamon, lemon-peel, alcohol, and
It is an agreeable stimulant cordial, used in languor, faint-
ıd sick stomach. Dose, f℥ss–ij.

*Spirit of Ammonia* (*Spiritus Ammoniæ*, U. S.), is only a
ı of gaseous ammonia in dilute alcohol; it is not much used.

OF TURPENTINE. (*Oleum Terebinthinæ*, U. S.)—Procured
ımmon turpentine, which consists of the volatile oil and resin,
llation. Called improperly *spirits of turpentine.*

—A colourless limpid fluid; odour, strong and peculiar;
)t and peculiar; rather lighter than water, with which it is

slightly soluble; its proper solvent is boiling alcohol. Chemically, a *hydrocarbon*; but when exposed to the air, absorbs oxygen, which converts part of it into resin.

*Effects.*—Small doses produce a warming, stimulating effect upon the stomach and the system generally, increasing the action of the heart and arteries. It is absorbed into the circulation, as proved by its being exhaled from the secretions. Apt to act upon the kidneys, sometimes with violence. Large doses act as a cathartic, and anthelmintic.

*Uses.*—A valuable stimulant, particularly in low forms of fever; more especially in *typhoid fever*, attended with dry tongue, delirium, tympanitis and subsultus. It is believed by some to produce an alterative impression upon the mucous membrane. Also in chronic catarrh, chronic dysentery, chronic nephritis, chronic gout and rheumatism; also in hemorrhages from the lungs and bladder. Dose, from 5 to 20 drops, given in emulsion, or dropped on sugar, and frequently repeated.

**Phosphorus** is one of the most powerful of the stimulants, but is rarely employed. It appears to have an especial tendency to the genital organs, and is reputed aphrodisiac. It should never be used in substance, but in ethereal solution. Dose, one-twelfth of a grain.

**Cayenne, or Red Pepper.** (*Capsicum*, U. S.)—The fruit of the *Capsicum annuum*, and other species; a native of the East and West Indies, but cultivated in our gardens. The fruit is in pods, 2 or 3 inches long, of a conical shape; colour, when ripe, bright red, which becomes darker by drying; colour of powder, red. The odour and taste of capsicum are peculiar, and depend on a fixed alkaline principle, named *capsicin*, also a pungent oil, and extractive. Alcohol and water extract its active properties.

*Effects.*—A powerful stimulant, especially irritant to the part to which it is applied.

*Uses.*—When a powerful local impression is required, as in rousing the action of the stomach; peculiarly applicable in malignant scarlet fever attended with putrid sore throat. A preparation consisting of two tablespoonfuls of powdered capsicum, one teaspoonful of common salt, half a pint of boiling vinegar, and half a pint of boiling water, is much used for this purpose in the West Indies. A saturated infusion may also be applied locally to the throat in gangrenous cases, with great benefit.

Dose of powder, 5 to 10 grains; of infusion (*Infusum Capsici*, U. S.), made with ʒij to Oss water—f℥ss; of the tincture, fʒj to fʒij. The strength of the gargle should be proportioned to the severity of the case.

# CLASS IV.

## NERVOUS STIMULANTS.

ICINES which stimulate the nervous centres, among their timulating operations. As they all probably first enter into ulation, their impression is first made there.

of the modes in which deranged nervous action most frequently sts itself is *spasm*, and from the power of this set of remedies rol it, they have been termed *antispasmodics*. This term, r, is not strictly applicable to them, since spasm depends upon sity of pathological conditions, being sometimes produced by ess of power in the nervous centres, and at others by a defi- Sometimes it is caused by congestion, or inflammation; in cases the nervous stimulants would be inadmissible, but de- would be required.

y are employed in all disorders connected with nervous de- ents of any sort, not accompanied with high arterial action. hysteria, hooping-cough, spasmodic asthma, insomnolency, &c. y all possess more or less of a fœtid odour, upon which their r virtues were, at one time, supposed to depend.

SK. (*Moschus*, U. S.)—Product of the *Moschus moschiferus*, nal somewhat resembling a deer, inhabiting the mountainous ts of Asia. The musk resides in an oval pod, about two and inches in length, and one and a half in breadth, situated be- the prepuce and umbilicus. Musk is a secretion of the lining ane of this pouch, and is found only in the male, and most ntly in the adult animal. It is in the form of reddish-brown granules, and, from its very high price, is extremely liable, lteration. Its chemical composition is very complex: it is mable.

.—Musk, when genuine, is one of the most powerful of the smodics. Given in full doses, it excites the circulation, as the cerebro-spinal system, producing an exhilarating effect, ccasional vertigo and headache; also slightly hypnotic. It loyed with advantage in retrocedent gout, obstinate singultus, le spasms not accompanied with inflammation, &c. Advan- sly given to children in enema. Dose, 5 to 15 grs. Given of emulsion,—dose, f℥i to f℥ij; of the *tincture*, gtt. xxx.

TOR. (*Castoreum*, U. S.)—A substance strongly resembling n its medicinal properties and therapeutical applications. It product of the *Castor Fiber*, or beaver, and is contained in llicles situated near the anus of the animal. It contains a peculiar matter called *Castorin*. Dose, gr. x–xx;—of the *tincture* (*Tinct. Castorei*, U. S.), gtt. xxx.

**ASSAFŒTIDA**, U. S.—A gum-resin—the product of the *Narthex assafœtida*, and possibly of some others. The *N. assafœtida* is an umbelliferous plant, growing in Persia and Affghanistan, having a long, tapering, perennial root, and very long leaves. Assafœtida is obtained by slicing off the top of the root, and collecting the juice as it exudes, which is then kneaded into masses, and packed for market.

At first it is rather soft, but hardens by exposure, which also renders it darker. Colour, externally, reddish-brown; internally, rather lighter, mottled with white tears, and shining; taste, bitter, acrid, and alliaceous; odour, very strong and alliaceous, but more powerful in the fresh juice. It softens by heat, and is inflammable. Chemically, it is a gum-resin, united to some volatile oil. Water dissolves the gum, which forms an emulsion with the resin; alcohol forms a clear, golden tincture.

*Uses.*—One of the most valuable of the antispasmodics; also stimulant, expectorant, and emmenagogue. Employed with advantage in hysteria, infantile convulsions, hooping-cough, chronic cough of a nervous character; also as a carminative, along with rhubarb and aloes, in the constipation of old persons, and as an emmenagogue. Advantageously given to children by enema, in which case it will often prove laxative.

Dose of substance, gr. v to x, given in form of pill;—of the emulsion (*Lac assafœtidæ*), f ℥ss to f ℥j;—of the tincture, f ʒss–j.

Assafœtida is sometimes used in the form of a plaster, in chronic swellings.

**VALERIAN.** (*Valeriana*, U. S.)—Root of the *Valeriana officinalis*, a perennial plant, indigenous in Europe, growing about two or three feet high. The root consists of a short tuberculated rhizome, from which issue numerous round, tapering fibres, of a yellowish-brown colour externally, and whitish internally. Taste, bitter and acrid; odour, when dry, strong, peculiar, and somewhat aromatic. It depends for its virtues on a yellow volatile oil, separable by distillation, and an acid, named *valerianic acid*.

*Uses.*—A mild antispasmodic and stimulant. Useful in hemicrania, combined with cinchona; also in slight nervous derangements. Best given in form of *infusion* (*Infusum Valerianæ*, U. S.), made with half an ounce of the root to a pint of boiling water; dose f ℥i to f ℥ij. Dose of the *oil of valerian*, 3 to 5 drops;—of the *tincture* (*Tinct. Valerianæ*, U. S.), f ʒj;—of the *ammoniated tincture* (*Tinct. Valerianæ Ammoniata*, U. S.),—made with the aromatic spirit of ammonia,—f ʒss; of the *fluid extract* (*Extractum Valerianæ Fluidum*, U. S.), gtt. x–xxx.

LIC. (*Allium*, U. S.)—Is decidedly antispasmodic, especially
s of children, to whom it may be advantageously applied in
m of cataplasms to the feet, to quiet the nervous irritation
h they are frequently liable in the course of disease. Some-
mployed as a counter-irritant to the spine, in cases of hoop-
gh. It is likewise expectorant.

OF AMBER. (*Oleum Succini*, U. S.)—*Amber* is a fossil resin,
duct, probably, of some extinct species of *coniferæ*, found on
res of the Baltic. It occurs in fragments usually of small
a yellowish colour, translucent, without odour, and inflam-
By destructive distillation it yields a volatile oil and *suc-*
*cid.*

*oil*, as first procured by distilling amber with sand, is thick,
a very dark colour and empyreumatic smell; when purified
stillation with water, it constitutes *Oleum Succini Rectifica-*
. S.; this has a clear amber colour, and a less offensive
it is the only preparation used internally.

s a decided stimulant to both the arterial and nervous
s; used chiefly in hooping-cough, infantile convulsions,
te hiccough, hysteria, &c.; also as a rubefacient to the
n infantile convulsions, and hooping-cough; and for rheu-
and palsy. It also increases the secretions, especially the
. Dose, gtt. v–xx, in emulsion.

*Skunk Cabbage* (*Dracontium*, U. S. *Sec.*)—root of *Dra-*
*ı fœtidum* (*Symplocarpus fœtidus*), is a powerful nervous
nt, especially in the fresh state. It deteriorates very much
and is hence not much used in regular practice. It has
nployed with benefit in asthma. Dose, gr. x–xx.

*e* and *Tea* possess decided virtues as nervous stimulants.
cessive use of either, especially of the former, is very apt to
dyspepsia and its attendant evils. They may be beneficially
l to as stimulants in nervous headache, and other mild ner-
sorders.

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## CLASS V.

## CEREBRAL STIMULANTS.

class of stimulants acts chiefly upon the brain, though, at
ie time, influencing both the circulation and the spinal ner-
stem. Like all other stimulants, their primary impression
wed by a proportionate degree of depression, which becomes
ro and dangerous, when the dose has been very large.

Their operation upon the system is usually described as consisting of three stages: 1, that of *stimulation*, which is transient; 2, that of *narcotism* or *sleep*, which is prolonged in proportion to the dose; 3, that of *depression*. The difference of these several stages of action have been ascribed to a supposed difference in their manner of operating; the immediate or stimulant effect being supposed to be due to action upon the nerves, while the narcotic depressing effects were attributed to a slower action, through absorption. They differ very much in their energy over the system, and are, by some, believed to act upon the different parts of the cerebral mass.

In large doses they are poisonous,—death resulting from asphyxia, in consequence of a suspension of the powers of the brain, or rather, of the medulla oblongata.

There is no class of remedies to which the system becomes so readily accustomed, and none in which such large doses can be tolerated, in especial diseases. Hence, when their use has to be continued, it is best to frequently substitute one for another, in order to prevent the formation of a dangerous habit. When once their use has become habitual, some degree of caution is requisite in abruptly withdrawing them, lest inordinate depression should follow.

They are used in medicine extensively for the relief of pain, which effect they accomplish by obtunding the sensibilities of the brain. Some are also employed for their stimulating effects; and many of them for an antispasmodic operation. They are, as a general rule, contraindicated in cases of plethora, fever of a high grade, and, especially, cerebral congestion or inflammation.

They have received different names according to their different effects; thus, *narcotics*, from their power of producing stupor; *anodynes*, from their ability to relieve pain; *soporifics* or *hypnotics*, from their tendency to promote sleep, &c.

**Alcohol, U. S.**—The product of a peculiar change in a saccharine liquid, known as the *vinous fermentation*. The conditions necessary for this change are a solution of sugar, the presence of some ferment, and a certain temperature. The chemical change which occurs is the conversion of sugar into alcohol and carbonic acid. The juices of various fruits contain all the elements for due fermentation. Thus the juice of the grape undergoes spontaneous fermentation, yielding *wine*; the juice of apples yields *cider*; the infusion of barley, *malt liquor*, &c. All such liquors—the result of fermentation—are named *fermented liquors*, and vary very much both as to flavour, and also as to the quantity of alcohol which they contain; thus the stronger wines contain about 20 per cent. of alcohol; the weaker wines about 10 or 12 per cent.; the malt liquors, as porter, ale, and beer, about 4 per cent. All the fermented

when submitted to distillation afford much stronger pro-
:alled *distilled liquors, ardent spirits*, or *spirituous liquors*.
', gin, rum, &c., are examples. These contain about 50 per
f alcohol. When the quantity is exactly 50 per cent., or one
ıe liquor is termed *proof-spirit*.

of the distilled liquors, when submitted to distillation, will
he *Alcohol* of the Pharmacopœia, called also *rectified spirits*
;,—having a sp. gr. of ·835. The alcohol thus procured con-
s much as 15 per cent. of water, from which it cannot be en-
ıeparated by any number of distillations. The *absolute alco-*
:hemists is never used in medicine.

*Alcohol Dilutum* of the Pharmacopœias consists of equal mea-
)f officinal alcohol and water: it is used in making certain
es; its strength is about that of the distilled liquors.

various alcoholic liquors are used in medicine chiefly as sti-
:s in low states of the system. The *fermented* liquors, as
ır the malt liquors, are usually preferred, unless a very de-
timulus is required, in which case *brandy* is employed.

*e-whey* is one of the best forms of administering wine; it is
)y adding half a pint of wine (Madeira, Sherry, or Teneriffe)
int of boiling milk, separating the curd from the whey, and
g the latter, if necessary, with rennet whey, and properly fla-
g with sugar and spices.

*malt liquors* may be employed as stimulants more freely than
they possess also tonic and nutritive properties: the best are
and ale; beer is apt to prove acescent.

)hol is frequently employed externally, particularly in the
ıf ardent spirits, as a rubefacient: the effect is increased by
; with red pepper. It will act as a local refrigerant if applied
o be allowed to evaporate.

evidence of the favourable influence of alcohol in disease, is
under its use, the pulse becomes fuller, and at the same time
; the skin moist, with an abatement of delirium.

:ER. (*Æther*, U. S.)—Chemically, the *oxide of ethyl*. Pre-
by distilling together 2½lbs. alcohol and 1½lbs. sulphuric acid.
her, as first procured, is contaminated with sulphurous acid,
wine, and some alcohol. It is purified from the acid by a re-
ıtion with potassa; and from the alcohol by agitation with
When thus purified it is named *rectified sulphuric ether*.

ɒ.—A colourless limpid liquid, of a strong, agreeable, and
ır odour; a hot, pungent taste; sp. gr. ·7, or a little less.
takes up one part in ten; very soluble in alcoh
d inflammable.

effects on the system resemble those of alcol
and transient. It will affect the brain, produ
ınd, like alcohol, its effects are diminished by

tition. Its impression is very speedily produced on the system by *inhalation;* by this means, a very powerful narcotic influence may be obtained. In this way it is much used as an anæsthetic agent.

As a medicine, ether is used chiefly as a powerful diffusive stimulant in cases of sudden and alarming prostration, as in metastatic gout, spasmodic asthma, angina pectoris, &c. It is best given in *emulsion,* made by rubbing it up with water by means of spermaceti. Externally applied it produces cold, if allowed to evaporate; or a rubefacient effect if confined to the skin.

Hoffman's Anodyne (*Spiritus ætheris compositus,* U. S.) is much employed. It contains oil of wine, ether, and alcohol, to the former of which it owes its peculiar fragrant odour, and which causes it to impart a milkiness to water; this is a test of its genuineness. It is much used to allay nervous irritations: it acts as an antispasmodic. Dose of ether, f℥ss to f℥j;—of Hoffman's Anodyne, about the same.

CHLOROFORM. (*Chloroformum,* U. S.)—Prepared by distilling together alcohol, water, and chlorinated lime. It is the *terchloride of formyle* ($C_2HCl_3$). It is a very thin, colourless liquid, having a peculiar ethereal odour, and a hot, aromatic, saccharine taste, volatile, not inflammable, insoluble in water, soluble in alcohol and ether; sp. gr. 1·49; boiling point 142°; remarkable for the very small size of its drop, requiring from 250 to 300 to make one fluid drachm.

Its action is that of a *direct sedative;* used as an anodyne and calmative both generally and locally. Much employed as an anæsthetic agent, but not without some danger; producing death apparently by suspending the heart's action. Dose, gtt. x–l. It has been found very useful in neuralgia.

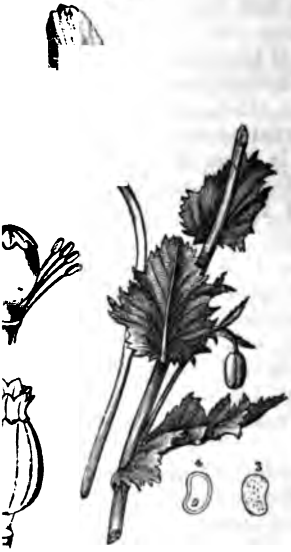
OPIUM, U. S.—The concrete juice of the unripe capsules of *Papaver somniferum,* which is probably a native of Persia, but is now cultivated in various parts of the world. It is an annual plant, attaining the height of 2 to 4 feet. The flower consists of four large petals (Fig. 7). There are two varieties of the papaver somniferum, named the *white* and *black* poppy.

The *capsules* (poppy-heads) are about one and a half to two inches in diameter, of a yellowish-brown colour, and filled with small seeds, which contain much fixed oil of a bland character, but no narcotic principle. The capsules themselves are slightly narcotic, and are sometimes employed in the form of decoction and syrup.

Opium is procured by making incisions in the half-ripe capsules, and collecting the juice which exudes, and properly drying it. It is obtained in large quantities in India, Persia, and Asia Minor; the chief supply of commerce being afforded from the latter country.

different sorts of opium are the *India, Persia, Turkey,* *yptian.*—The India variety is almost exclusively consumed a and China; it consists of three varieties, *Malwa, Patna,* and 's opium. The Persian very seldom comes to this country.

Fig. 7.



There are two kinds of Turkey opium found in the markets,—the *Smyrna* and *Constantinople* opium.

*Smyrna opium* is, on the whole, the best; it comes in irregular rounded, or flattened cakes, covered with the capsules of some species of *rumex*, and enveloped in leaves; has a reddish-brown colour; a softish consistence in the centre; becomes darker and harder on exposure; has a strong narcotic odour.

*Constantinople opium* is seldom seen in our markets;—occurs in irregular flattened cakes, presenting the remains of a leaf on the exterior.

*Egyptian opium* comes in flat cakes about three inches in diameter, free from capsules; of a darker colour, and more mucilaginous than the Smyrna variety.

*ks of good opium* are a strong narcotic odour, a bitter acrid vhen long chewed, exciting irritation of the fauces and mouth; ish-brown colour; when drawn across white paper should n interrupted stain.

ım is inflammable; it imparts its virtues to water and alco- *Chemical composition* very complex; most important ingre- is *morphia*;—contains also *narcotina* and *codeia*, which are e principles; and *narceine*, which is neutral; also, *meconin*, *'c acid, thebain* or *paramorphia, gum, extractive,* and a vola- nciple.

*siological Effects.*—Those of a stimulant narcotic; it excites culatory and nervous systems, and in full doses affects the

irst impression is to stimulate the heart and arteries, as evi- by an increased frequency of the pulse, and greater heat of This is soon followed by diminished sensibility, calmness, ep, with abatement of pain, and suspension of mucous secretions, except that of the skin. This is succeeded by a degree of prostration, evidenced by a feeble pulse, cool, moist skin, languor, and depression. In large doses it is a narcotic poison, the symptoms being stertorous breathing, a slow full pulse, great insensibility, and a livid countenance; followed by a feeble and threadlike pulse, relaxation of the muscles, and death. The *treatment* consists in an immediate evacuation of the stomach, either by the stomach-pump, or by a prompt emetic (zinci sulp. et ipecac.), counteracting the tendency to sleep by external irritation; arousing the sensibility by dashing cold water upon the face and chest; and supporting the system, when it begins to sink, with diffusible stimulants.

*Therapeutical Applications.*—Opium is employed in a great number of diseases; it is perhaps the very best *anodyne*, and is used for this purpose to relieve the pain of neuralgia, cancer, colic, &c. As a *hypnotic* or *soporific*, it is used in cases of morbid vigilance, except when dependent on inflammation of the brain. As a *stimulant* it is valuable in low forms of fever. As an *antispasmodic*, it controls spasm more effectually than most other remedies; in tetanus very large doses are required. As a *diaphoretic* it is useful in bowel affections, typhoid pneumonia, rheumatism, &c. It is also employed to arrest morbid discharges. On certain constitutions it produces peculiar effects, as obstinate wakefulness, nausea, delirium, and a tingling of the skin, attended with a miliary eruption.

The average dose of opium is one grain; but in mania-à-potu and [illegible], enormous doses are required. It may be applied *endermically* with advantage, in cases where the local effects are required; or by enema.

The following preparations are officinal in the United States Pharmacopœia:

*Tinctura Opii* (*Laudanum—Thebaic tincture*).—Prepared by macerating opium, ℥ijss in diluted alcohol, Oij. It is a saturated tincture, and should always be of uniform strength. It contains about 37 grains to the fluid ounce. When long kept its strength is increased by the evaporation of the alcohol, in which case danger might result from administering it to infants. The dose equivalent to a grain of opium is ♏xiij, or 25 drops. Laudanum is frequently used as an external application.

*Tinctura Opii Camphorata* (*Paregoric Elixir*).—Prepared by the action of dilute alcohol on opium, benzoic acid, camphor, oil of anise, and honey. It contains two grains of opium in every fluidrachm. It is much used in diarrhœa and coughs;—dose, about 18 drops equivalent to one of laudanum.

*Tinctura Opii Acetata* (*Acetated Tincture of Opium*).—Prepared by macerating opium in alcohol and vinegar combined;—dose ♏x.

*Acetum Opii* (*Black Drop*).—Prepared by macerating opium,

;, sugar, and saffron in dilute acetic acid. It is a strong tion;—dose, 7 to 10 drops.

m *Opii* (*Wine of Opium*).—Made by macerating opium ne of the aromatics in wine;—dose, ♏x.

*hiæ Sulphas* (*Sulphate of Morphia*).—Prepared by acting trong watery infusion of opium, with ammonia, which com- ith the meconic acid, precipitating the morphia in a crystal- te; purified by boiling alcohol, and separated from the nar- by means of ether. By these means the morphia is obtained stalline state; it is next neutralized with sulphuric acid. It in fine needle-shaped crystals, freely soluble in water;—dose, in. The solution is officinal, (Liquor Morphiæ Sulphatis, U. contains one grain to f℥j of water;—dose, fʒj–ij.

*hydrochlorate* and *acetate* of morphia are also used; their ies are similar to those of the sulphate.

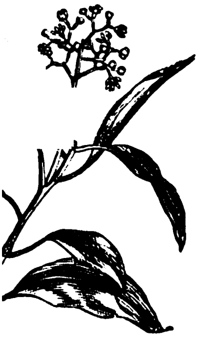
best *tests* for the presence of morphia are the *sesquichloride* , which causes a blue colour; and *nitric acid*, which strikes -red tint.

salts of morphia are much employed *endermically;* they pos- the valuable properties of opium.

TUCARIUM, U. S.—The inspissated juice of the *Lactuca sativa*, *len lettuce*, which abounds in a milky juice, especially at the of flowering. It is prepared by pressing out the juice with and evaporating to a proper consistence. It is of the consis- of a dry extract, of a brown colour, and strongly resembles in its effects, except that it does not produce constipation, ninish the secretions. Its dose is from two to five grains.

PHOR. (*Camphora*, U. S.)—Product of the *Camphora offici-*, or the *Laurus camphora* of Linnæus, an evergreen tree, of considerable height, growing in China and Japan. All parts of the tree abound in the odour and taste of camphor, but this is yielded in greatest abundance by the roots and young branches, when they are cut up, boiled in water, and sublimed into inverted straw cones. Thus obtained, it constitutes the *crude camphor* of commerce. It is purified by resublimation, along with quicklime, when it becomes *refined camphor*.

Fig. 8.



It is solid, colourless, and translucent, with a crystalline texture, tough and difficult to pulverize; has a strong penetrating odour, with a bitter pungent taste, followed by a sense of coolness; rather lighter than water; very volatile and inflammable; but slightly soluble in water; very soluble in alcohol, ether, the fixed and volatile oils.

*Borneo* or *Sumatra* camphor is in white crystalline fragments; it occurs in solid masses in the cavity of the wood of the *Dryobalanops camphora.*

*Effects on System.*—In moderate doses, it produces a gentle excitement, heat of skin, and fulness of pulse, with a tendency to diaphoresis. Large doses prove narcotic. Sometimes it seems to act as sedative. It is applicable in typhoid cases, accompanied with nervous derangement. It is sometimes usefully combined with opium, in rheumatism, &c.

Dose, in substance, from 5 to 10 grains. The *emulsion* is made by rubbing up the camphor with gum, sugar, myrrh, and water.

*Aqua Camphoræ*, U. S. (*Camphor Water*)—is made by adding a few drops of alcohol to camphor, and then rubbing up with carbonate of magnesia and water; it contains 8 grains to every fluidounce.

*Tinctura Camphoræ*, U. S., often called *Spirits of Camphor*, contains two ounces of camphor to the pint of alcohol;—chiefly employed as an embrocation to sprains and bruises; used internally in colic and cholera;—dose, 5 drops to f℥j.

*Linimentum Camphoræ*, U. S. (*Camphor Liniment*)—consists of camphor dissolved in olive oil; used as a mild embrocation.

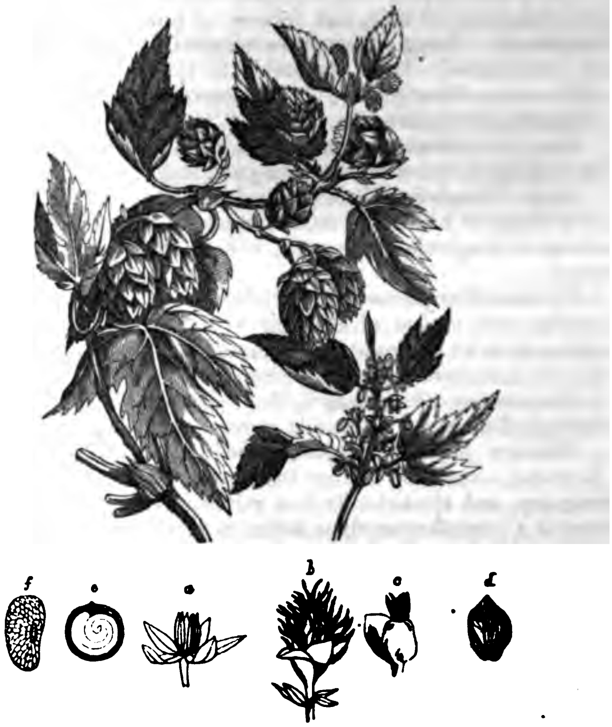
*Tinctura Saponis Camphorata*, U. S., improperly called *Soap Liniment*,—made by mixing together camphor, Castile soap, oil of rosemary, and alcohol. It is a yellowish oleaginous liquid, much used as a stimulant anodyne lotion in sprains, rheumatism, &c.

*Linimentum Saponis Camphoratum*, U. S., commonly known as *Opodeldoc*,—made like the last-mentioned preparation, except that [illegible] animal soap is used instead of a vegetable one, in consequence [illegible] which it coagulates on cooling, and yields a soft solid, which liquefies at the temperature of the body;—*uses*, the same as the former.

**Hops.** (*Humulus*, U. S.)—The *Humulus lupulus* (Fig. 9), is a native of Europe and North America. It has a perennial root, which sends up annually several rough, flexible, twining stems. The male and female flowers grow on different plants. The part used is the flowers, or rather strobiles, which are collected when ripe, dried, and packed in bales. They have a greenish-yellow [illegible]; a bitter, astringent, and somewhat aromatic taste; impart [illegible] virtues to water and alcohol. A reddish powder is found at [illegible] base of the scales, termed *lupulin*, which contains all the virtues of the hops. These virtues depend upon a peculiar principle [illegible] which resides both in the hops and in the powder.

[illegible] m.—Stomachic, tonic, and slightly narcotic. The s emanations from hops are hypnotic; for this purpose the *llow* is employed, made by previously moistening the hops pirits, to increase the effect, as well as to prevent a rustling Hops are extensively employed in making malt liquors. are best given in the form of infusion (*hop tea*), made in the

Fig. 9.



tion of ℥ss to Oj water. The decoction and extract are ob- able. Lupulin may be given in the dose, 6 to 12 grains, into a pill. The tincture of lupulin (*Tinc. Lupulinæ*) is l, as well as the tincture of hops (*Tinc. Humuli*). They are nt remedies in the dyspepsia of drunkards, and in mild mania- ;—dose, f℥ss to f℥j. Hops are sometimes applied exter- in the form of poultice; it has an anodyne effect.

ERSWEET. (*Dulcamara*, U. S.)—It is doubtful whether this e should have a place among the narcotics, since its influence e cerebral functions is very feeble. The plant yielding it is the *Solanum dulcamara*, or *woody nightshade*; the parts employed are the stem and twigs, which should be collected in the autumn. They are about the thickness of a common quill, of a light brownish-gray colour, without odour, and have a bitter taste followed by sweetness.

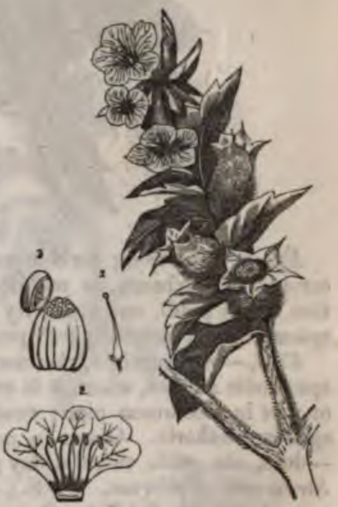
*Uses.*—Their chief employment is as an alterative in chronic skin diseases, given in the form of decoction (*Decoctum Dulcamaræ*, U. S.), made by boiling ℥j in Ojss of water down to Oj. It may also be used in the same cases advantageously as a wash. Its virtues depend on an alkaline principle named *solania*, which is also found in the *Solanum tuberosum*, or common potato.

Dulcamara has been supposed by some to be antaphrodisiac, and for this purpose has been employed in the cases of the insane.

*Extractum Dulcamaræ*, U. S.—Dose, gr. v–x.

HENBANE LEAVES AND SEEDS. (*Hyoscyami Folia et Semen*, U. S.)—Leaves and seeds of the *Hyoscyamus niger*, a biennial plant (Fig. 10), native of England, growing from one to three feet high; thickly furnished with sessile leaves, of a pale-green colour. All parts abound in narcotic properties, but the leaves and seeds alone are officinal. The leaves of the second year, and of plants grown in sunny situations, are said to be the strongest. They ought to have a mucilaginous, slightly bitter taste, and should retain some of the narcotic odour of the plant. They depend for their virtues upon a peculiar crystalline, alkaloid principle, named *hyoscyamia*; this is yielded to water and alcohol.

Fig. 10.

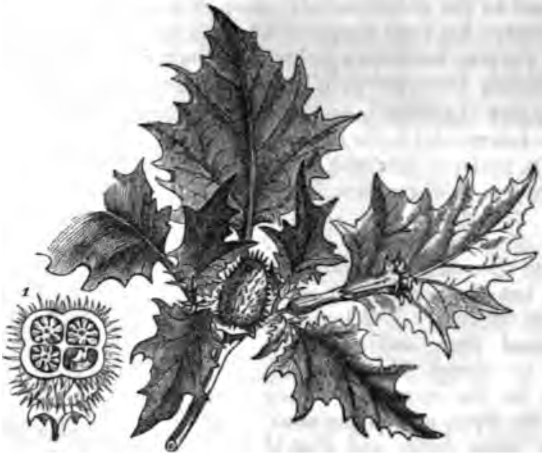


*Effects.*—Very slightly, if at all, excitant; narcotic, anodyne, and soporific; resembles opium in moderate doses, except that it does not constipate. Large doses occasion dizziness, dilatation of the pupil, and slight delirium. It may be used in cases requiring the exhibition of a gentle anodyne and calming remedy. It is given in *powder*,—dose, 5 to 10 grains; in *extract* (inspissated juice), (*Extractum Hyoscyami*, U. S.)—dose, ½ gr. to 3 grains; in *alcoholic extract*—prepared by percolation with alcohol on the *dried* leaves, and evaporating to a proper consistence,—dose, gr. ij; in *tincture*,

, f℥ss–j. The preparations of hyoscyamus, as found in the
are very variable.

RNAPPLE **LEAVES AND ROOT**. (*Stramonii Folia et Radix*,
—The *Datura stramonium* (Fig. 11), is an annual, very com-
different parts of the world, growing from 3 to 6 feet high.
rts are acrid and narcotic, but the leaves and seeds only are
n medicine. These owe their efficacy to a very poisonous
r principle, called *daturia*.

Fig. 11.



*cts.*—A strong acrid narcotic; diminishes sensibility, causes
l disturbance, as manifested by giddiness, headache, dilata-
the pupil, and obscurity of vision; also, calmative and anti-
dic; occasionally will produce diaphoresis and diuresis.
*l*,—in neuralgia, rheumatism, epilepsy, and mania; also in
dic asthma, where it is employed by smoking the dried leaves
in a common pipe; caution is required in the case of the
r plethoric. Given in *powder*—dose, 2 or 3 grains; in *seed*
, one grain twice a day; *extract of the leaves* (*Extractum
onii Foliorum*, U. S.),—dose, one grain twice a day;
*of the seeds* (*Extr. Stram. Seminis*, U. S.),—an alcoholic ex-
-dose, ¼ to ½ a grain.

extract is sometimes used by American oculists to dilate the
f the eye previous to the operation for the cataract.

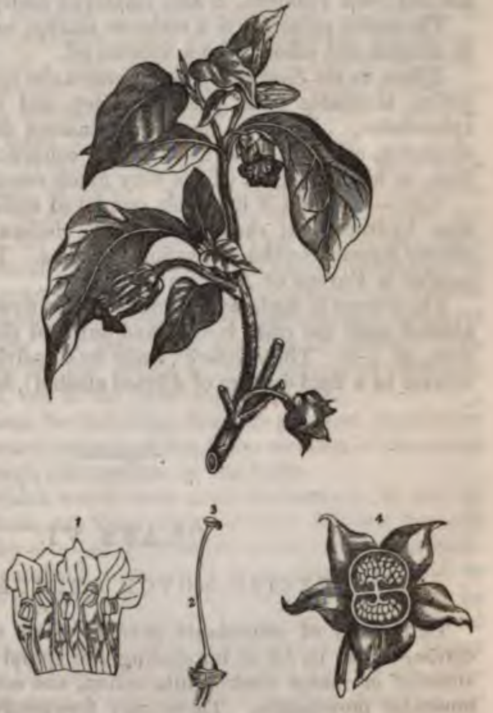
ointment (*Unguentum Stramonii*, U. S.) is best made by
the fresh leaves in lard: it has a light-green colour, and
employed in the same cases as the belladonna ointment.

DEADLY NIGHTSHADE. (*Belladonna*, U. S.)—The *Atropa belladonna* (Fig. 12) is an herbaceous perennial plant, a native of Europe. It has a thick fleshy root, several downy, erect stems; ovate, entire leaves, and pendent, bell-shaped, purplish flowers. All parts are possessed of narcotic properties, though only the leaves are officinal. The dried leaves have a dull-greenish colour, a slight narcotic odour, and a bitter nauseous taste. Active principle, *atropia*, a violent poison.

*Effects, &c.*—Anodyne, antispasmodic, and rather sedative; one of its earliest impressions is a dryness and stricture of the fauces; it often causes dilatation of the pupil, giddiness, dimness of vision; in large doses, great thirst, dysphagia, violent delirium, blindness, and occasionally convulsions, coma, and death. Its fatal effects are usually accompanied with marks of gastro-intestinal inflammation.

*Uses.*—As an anodyne, to relieve the pain of neuralgia; as a resolvent or discutient in chronic indurations; as an antispasmodic in the latter stages of hooping-cough; by some supposed to be a prophylactic in scarlatina. Externally applied, it produces a local anodyne impression; and if applied to the eyes, it causes dilatation of the pupil, for which purpose it is frequently used by the oculist. It is employed in substance, infusion, and extract. Dose of *powder*, one grain twice a day; of the *extract*—an inspissated juice—¼ of a grain to one grain.—*Extract. Belladon. Alcoholicum*, U. S., dose the same. The dose in each case is to be increased until dryness of the throat is produced.

Fig. 12.



*lastrum Belladonnæ*, U. S.,—made by mixing the extract
ad plaster—is used to relieve neuralgic pains; also in dys-
rhœa.

*uentum Belladonnæ*, U. S.,—made by rubbing up ℨi of the
; with ℥i of lard. Used to painful or sprained joints, and
mes applied to the rigid os uteri in cases of protracted labour;
lso for dilating the pupil for the operation of cataract.

three last-mentioned narcotics, from their tendency to produce
m, have been sometimes named *Delirifacients.*

RACT OF HEMP. (*Extractum Cannabis*, U. S.)—The plant
yields this medicine is the common hemp (*Cannabis sativa,
dica*), a native of Persia, but cultivated throughout the world.
etes a peculiar resinous matter, which is much more abundant
plants grown in India than in those of Europe or America.
esin is sold by the natives under the name of *cherrus*. In
st, the dried flowering tops, from which the resinous matter
t been removed, is also employed under the name of *gunjah.*
active principle is a resinous matter, called *cannabin*, soluble
hol and ether; also a volatile oil.

*cts on the System.*—It exhilarates the spirits, increases the ap-
alleviates pain, produces sleep, and is stated to act as an
isiac. In large doses it occasions delirium of a peculiar
ter, attended with a cataleptic condition. Dr. Pereira says,
n his hands, its effects very much resembled those of opium.
.—In India it has been employed with great benefit in teta-
ydrophobia, rheumatism, and cholera; its operation being
directed to the relaxation of spasm. It has not been so suc-
in Europe or America.

*extract* is made by boiling the dried flowering tops (gunjah) in
l until the resin is dissolved out, and then distil off the spirit;
r. j–v. The *tincture* (made by dissolving three grains of the
; in a fluid drachm of diluted alcohol), is sometimes employed.

## CLASS VI.

### EXCITO-MOTOR STIMULANTS.

s class of stimulants produce their effects through *reflex*
—that is, by so impressing the spinal cord as to excite the
r or motor centres into action, and consequently to produce
lar movements. These may frequently be of a spasmodic
ter, and even amount to general convulsions.

As remedial agents, they are employed where it becomes necessary to arouse the muscular structure into action, though usually in cases of local or temporary torpor, as in partial paralysis, or in inertia. Some of them possess decided narcotic properties.

NUX VOMICA, U. S.—Seeds of the *Strychnos nux vomica*, a middling-sized tree, growing in the East Indies. The fruit is a berry about the size of an orange, containing many seeds imbedded in a juicy pulp. These are rather less than an inch in diameter, circular and flattened, slightly concavo-convex. Externally they are covered with a whitish silky down. The interior is hard, of a horny consistence; difficult to powder. They have no odour, but an intensely bitter taste; they yield their active principle to dilute alcohol more readily than to water.

Nux vomica owes its virtues to two alkaline principles which it contains, called *strychnia* and *brucia*, which exist in combination with *igasuric acid*.

*Strychnia* may be procured either from nux vomica, or from *St. Ignatius' bean*, which contains it in large quantities. As found in the shops it is usually granular, but it may be made to crystallize. Colour, white; no odour; taste, intensely bitter; almost insoluble in water; soluble in alcohol; slightly so in ether; unites with acids to form salts. *Brucia* is found in *false Angustura bark;* its properties are similar to those of strychnia, though feebler.

*Effects on System.*—Given in very small doses it acts as a tonic to the digestive organs; in rather larger quantities, its influence seems to be directed chiefly to the muscular system, through the medium, however, of the spinal marrow. There is, at the same time, an increased sensibility to external impressions, trembling of the limbs, and slight convulsive motions, which subsequently extend to the involuntary muscles, producing, in poisonous doses, the most violent tetanic spasms; the individual perishes apparently from asphyxia, brought on by the spasm of the respiratory muscles. There is no narcotism, nor is the pulse much affected.

There is strong reason for believing that the peculiar impression of the medicine is exerted entirely through the medium of the spinal marrow, and not through the medium of the brain.

*Uses.*—The cases which would seem most obviously to be met by nux vomica, or strychnia, are those attended with deficient nervous energy, as indicated by a torpid or paralytic condition of the muscles. The cases of paralysis to which it is applicable are such as are not attended with organic lesion of the brain. It is said to be e advantageous in paraplegia than in hemiplegia; also in local ies, and in incontinence of urine, depending on a loss of power he muscles of the bladder. The first obvious sign of its influ- on the system, in cases of paralysis, is a tingling sensation ex- ited in the part affected.

of the *powder*, 5 grs. three or four times a day, gradually ed until a sensible effect is produced. A better form is the ic *extract* (*Extrac. Nucis Vomicæ*, U. S.), the dose of which is alf a grain to two grains. The *tincture* (*Tinc. Nucis Vo-* U. S.) is made in the proportion of ℥iv to the pint; dose, xx.

of strychnia, $\frac{1}{12}$th to $\frac{1}{6}$th of a grain, three times a day. chnia may be applied *endermically* in cases of amaurosis, not of an organic character,—half a grain being sprinkled blistered surface on the temple.

**OT.** (***Ergota***, U. S.—*Spurred Rye.*)—A diseased product of *ale cereale*, or common rye, caused by a fungous parasite,—in m of numerous sporidia, visible by the microscope. This , when lodged upon any of the *grasses*, will produce the dis- ondition of the seed called *ergot* or *spur*. Rye grown upon id wet soils is most subject to it. Occurs in spurred grains alf an inch to an inch in length, cylindrical, tapering, and like a cock's spur; colour, externally purplish-brown; inter- dull white; odour, in mass, resembling that of putrid fish; crid and unpleasant;—virtues to boiling water and alcohol. ains an oil and *Ergotine*.

*ts.*—In the ordinary dose it occasions no perceptible effects male system; but on the female it produces decided uterine tions, particularly in the impregnated condition; and these tions are of a *tonic* nature. It also sometimes produces , giddiness, and stupor, indicating a narcotic influence.

tized grain, used for a length of time, has been known to e fatal effects—such as dry gangrene, typhus fever, and con- is.

.—Chiefly to facilitate labour; but *only* when the delay arises from a want of contractile power of the uterus;—also to aid expulsion of the placenta, and of clots, hydatids, and polypi; uterine hemorrhage.

of powder, ℈j,—to be repeated if necessary. *Infusion*, made j of ergot to f℥iv boiling water; dose, one-third. *Vinum* , U. S.,—dose, fʒj to fʒiij. Ergot should not be kept in wdered state.

## CLASS VII.

### ARTERIAL SEDATIVES.

ICINES which tend directly to depress the action of the circu- producing a slower and weaker pulse, and diminishing the frequency of the respirations, without any special tendency to the nervous system.

They have also been named *refrigerants*, from the cooling effect generally produced upon the surface of the body by their use, owing to a diminished capillary circulation.

They are indicated in cases of high vascular action, as the different phlegmasiæ, and fevers unaccompanied with typhoid symptoms. Although *sedative* in their general impression upon the system, some of them, as antimony, produce a local stimulant effect upon some of the organs.

They cannot be employed as substitutes for bloodletting, since the latter actually takes away materials from the circulating fluid; but they are valuable adjuvants to this treatment, and are much employed with this view.

ANTIMONY. (*Antimonium*, U. S.)—The antimonials are the most sedative of all the refrigerants, and are used very extensively with this indication. Given in quantities too small to produce any obvious effect in the healthy system, they nevertheless prove *alterative* in disease. In rather larger doses, though still too small to occasion nausea, they produce a decided sedative action. In still larger doses, they cause nausea, thereby directly increasing their power as sedatives or refrigerants. In yet larger quantities they vomit. Although sedative to the system at large, the antimonials act as stimulants to the lungs, skin, and kidneys, and sometimes the liver and salivary glands. They act by being taken up by the circulation. Their effects continue for some time after the suspension of their use, and by cautiously increasing the dose, great *tolerance* of the medicine may be induced.

The preparations of antimony most used are the following:—

1. *Tartar Emetic.* (*Antimonii et Potassæ Tartras*, U. S.)—Prepared by saturating the excess of acid in the bitartrate of potassa (cream of tartar), with the sesquioxide of antimony, by boiling them together. It should always be crystallized, to free it from impurities.

*Prop.*—A white, crystalline salt, without odour, of a nauseous, metallic taste, efflorescent, very soluble in water, insoluble in pure alcohol; decomposed by the pure alkalies, alkaline carbonates, and the vegetable astringents.

*Effects and Uses.*—The best of the antimonials; used as an alterative in chronic cutaneous diseases, and in scrofulous affections; but requires to be persevered in for some time. Dose as an alterative, $\frac{1}{32}$ to $\frac{1}{16}$ gr. In rather larger quantities, as from $\frac{1}{12}$ to $\frac{1}{4}$ gr., it acts as a refrigerant, and may be given whenever the action is above the normal standard, as in fevers, inflammations—especially of the lungs,—when it acts also by increasing the secretion. It

n given in very large doses in acute pneumonia and other
l diseases, on the *contra-stimulant* plan of Rasori, as a sub-
for the lancet, the patient taking from one to two grains,
wards, every two hours. There is considerable risk, how-
this method, arising from the excessive depression which is
nes produced, and also from the effect on the stomach and

*poisonous* effects are an austere, metallic taste, excessive
and vomiting, burning pain in the stomach, colic, extreme
ion of the circulation, spasms, watery evacuations from the
and great prostration; resembling very much a violent case
era. The remedies are demulcent drinks, astringent infu-
nd stimulants, both internal and external.

*monial Wine.* (*Vinum Antimonii*, U. S.)—A solution of
metic in wine, in the proportion of gr. ij to f℥j. The best
ust be used—as the Teneriffe, Sherry, or Madeira, or else
ation will not be perfect. This preparation is employed for
horetic and expectorant effects; also as an emetic for chil-
Dose 20 drops to fʒj.

*ar Emetic Ointment.* (*Unguentum Antimonii*, U. S.)—
y rubbing up ʒij of powdered tartar emetic with ℥j of lard.
the skin as a counter-irritant by its pustulation, in chronic
l disorders of the chest or abdomen.

*Precipitated Sulphuret of Antimony.* (*Antimonii Sul-*
*m Precipitatum*, U. S.)—Prepared by boiling together the
huret of antimony and a solution of potassa; strain, and
phuric acid while yet hot; then wash away the sulphuret of
m, and dry the precipitated sulphuret. It is an orange-red,
le powder, composed, chemically, of a mixture of the oxide
phuret of antimony.

*nes Mineral* is a similar compound, made like the preceding,
e exception that no acid is added, but the precipitate falls
eously.

*len Sulphur of Antimony* is formed by adding an acid to the
after the precipitation of the Kermes mineral: it contains
ncombined sulphur.

of these preparations are much used at present. They are
nally given as alteratives, combined with guaiac and calo-
the form of *Plummer's Pill*, in chronic skin diseases. Dose,
grs.

*ntimonial Powder* (*Pulvis Antimonialis*), made in imitation
*es's Powder.*—Prepared by burning the sulphuret of a
rtshorn shavings, in a wide-mouthed vessel. It
ate of lime and oxide of antimony; colour, white;
l; insoluble in water; uncertain in its operation.
nd cutaneous diseases. Dose, 3 to 8 grs.

### VEGETABLE ACIDS.

Nearly all of them are refrigerant, and are well adapted, when properly diluted, to inflammatory and febrile complaints. Too long used, they enfeeble digestion, and produce symptoms of marasmus. Those most employed in medicine are the Acetic, Citric, and Tartaric.

**Acetic acid**—(*Acidum Aceticum*, U. S.)—in the form of vinegar, diluted with water, is a refreshing drink in febrile cases. It is also useful as a cooling application to the surface. The strong acetic acid is an irritant poison. Dilute acetic acid and distilled vinegar are of about equal strength.

**Citric acid**—(*Acidum Citricum*, U. S.)—exists in the lemon, lime, sour orange, tamarind, and many other fruits. It is used either in the form of lemon-juice, or the solid crystalline state. The decomposition of lemon-juice may be partially prevented by exposing it to a freezing temperature, whereby all the watery parts are separated, and the juice much concentrated; or by making it into a syrup with sugar.

The crystalline acid is prepared by saturating lemon-juice with chalk, and then decomposing the citrate of lime by sulphuric acid, and evaporating. The crystals are large, white, transparent rhombs, of a very sour taste, soluble in water; apt to be adulterated, if in powder, with tartaric acid; fraud detected by carbonate of potassa, which causes no precipitate with citric acid. A solution in the proportion of ʒixss citric acid to Oj water, is about the strength of lemon-juice; ℈j of acid to Oj water is the proportion for lemonade. It is a valuable *antiscorbutic*.

**Tartaric acid**—(*Acidum Tartaricum*, U. S.)—is found in the juice of the grape, tamarind, &c. It is much employed as a cheap substitute for citric acid.

### SALINE SUBSTANCES.

Most of the neutral salts produce a refrigerant effect upon the system, both as a direct result, and indirectly, in consequence of the purgative power which many of them possess. Most of them are described under the head of *Cathartics*. The one most especially refrigerant, is

**Nitrate of Potassa** (*Potassæ Nitras*, U. S.), commonly called *Saltpetre*, or *Nitre*. It is procured from the banks of the Ganges, as a natural exudation from the soil; also from artificial nitre-beds in Europe. When purified, the crystals are large, six-sided prisms, with numerous transverse striæ; no odour; taste, saline and cooling; soluble in water, not in pure alcohol; fuses by heat, when it

run into moulds; a high heat decomposes it. *Effects.*—In
te doses, it reduces the circulation, and diminishes the tem-
e of the body, not, however, as was supposed, by its solution
stomach. It probably exerts some chemical influence on the
rendering it less inflammatory. At the same time, it is diu-
r diaphoretic, according as the patient is kept cool or warm.
quantities are apt to produce nausea and vomiting, and even
us effects; though very considerable doses may be taken
mpunity, provided they be given largely diluted in some
ginous fluid.

*l* in fevers of a high grade, as an adjuvant to the lancet; also
seful in hemorrhages, and in all inflammations, except those
stomach and bowels. Often combined with tartar emetic,
metimes with calomel. Dose, 5 to 10 grs. every hour or two.

*litrous Powders* consist of a combination of nitre, tartar
, and calomel,—much employed in febrile complaints of a
character.

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# CLASS VIII.

## NERVOUS SEDATIVES.

SE are medicines which occasion great depression of the sys-
ttended often with nausea, sometimes with vomiting and
g, weakness and irregularity of pulse, syncope, giddiness,
ed vision, and occasionally convulsions, delirium, and stupor.
re named by some writers *sedative narcotics*, from their effects
brain. The mosti mportant of this group are Foxglove and
o.

GLOVE. (*Digitalis*, U. S.)—The *Digitalis purpurea* is a
l plant with long radical leaves, from the midst of which
ct stem arises the second year, terminated by a raceme of
ful purple flowers. The parts used in medicine are the leaves,
require to be selected and dried with great care, and pre-
so as to exclude the light. When dried they should have a
een colour, a slight odour, with the strong bitterness of the
plant. They contain a peculiar principle termed *digitalin*,
ich their activity depends.

*cts on System.*—Those of a sedative narcotic; causes tight-
d dull pain in the forehead, vertigo, dimness of vision, con-
of intellect, great reduction of the heart's action—in some
s much as 30 pulsations a minute. It is also powerfully
c. Poisonous doses produce nausea and vomiting, great

prostration, cold sweats, hiccough, convulsions, and death. It is cumulative in its action, and therefore its effects require to be carefully watched.

Digitalis is chiefly used to diminish the action of the heart in hypertrophy and dilatation of that organ, also in certain forms of nervous palpitations; in aneurism of the aorta; in inflammation, as an adjuvant to the lancet; in scarlatina, pertussis, epilepsy, mania, and some forms of hemorrhage; also as a diuretic. Dose in substance gr. j, two or three times a day; of the *infusion* (*Infusum Digitalis*, U. S.), made by adding ʒij to Oj of water, f℥ss; of the *tincture* (*Tinc. Digitalis*, U. S.), ♏x to ♏xxx.

TOBACCO. (*Tabacum*, U. S.)—Leaves of the *Nicotiana tabacum*, an annual plant, native of tropical America. It has an erect, hairy stem, long sessile leaves, viscid and hairy. As found in the shops it is of a yellowish-brown colour; strong, narcotic, penetrating odour; bitter, acrid, and nauseous taste. Alcohol and water extract its virtues. Its active principle, named *nicotina*, is a volatile, alkaline, oily liquid, without colour, with a very acrid taste, and an odour resembling that of tobacco; it is extremely poisonous. Tobacco contains another principle named *nicotianin*, a fatty substance, seeming to owe its properties to containing a little nicotina. An *empyreumatic oil* is yielded by the destructive distillation of tobacco; it gives the peculiar odour to old tobacco-pipes; it is very poisonous.

*Effects on System.*—In very small quantities, it is a sedative to the system at large; in larger doses, acts on the brain, producing vertigo and stupor, together with nausea and vomiting, extreme depression, coldness of the skin, syncope, and sometimes convulsions. Small doses repeated are more dangerous than a large one, in consequence of the latter being rejected from the stomach. In its effects, it resembles digitalis, surpassing it, however, in its depressing influence over the muscular system, but being inferior to it in its influence over the circulation.

*Uses.*—Chiefly to relax the muscular system, as in strangulated hernia, obstinate constipation from spasm of the bowels, or retention of urine from spasm of urethra. Not much given by the stomach on account of the excessive nausea it produces; chiefly by *enema* (infusion, made in proportion of ʒj tobacco to Oj of water,—one-half to be used at once). Dangerous and even fatal symptoms have resulted from the tobacco injection. It may also be used in the form of cataplasm, in cases of spasmodic croup, lead colic, tetanus, and rheumatic affections.

*Wine.* (*Vinum Tabaci*, U. S.)—Used as a nauseant and diuretic. *Tobacco ointment* (*Unguentum Tabaci*, U. S.), is made by boiling fresh tobacco in lard; it is used in cutaneous diseases, especially *tinea capitis*. The ointment is sometimes made from the oil.

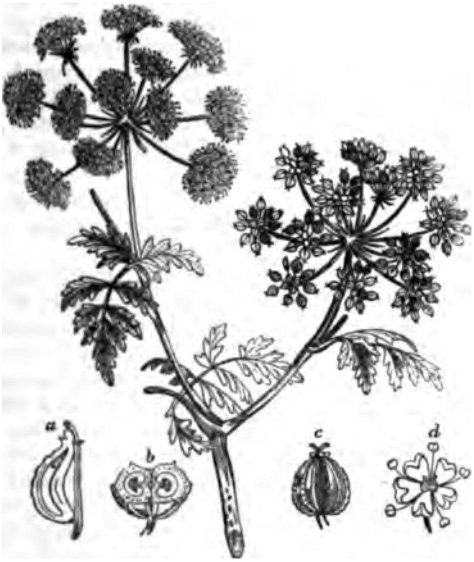
IAN TOBACCO. (*Lobelia*, U. S.)—The *Lobelia inflata* is a
of America, where it was employed as a medicine by the
ines. It is an annual plant, growing a foot or more in height,
n erect stem; the fruit is an inflated capsule. The whole
is used in medicine. It contains a volatile, acrid, peculiar
ple, named *lobelina*, analogous to *nicotina*.
*cts.*—Narcotic, acrid, emetic, and antispasmodic, strongly re-
ing those of tobacco. It is chiefly used as an antispasmodic
hma, either by giving it in full doses so as to excite vomiting,
small quantities frequently repeated till nausea comes on. Its
on may be used in the form of enema in strangulated hernia.
internally chiefly in the form of *tincture* (*Tinc. Lobeliæ*, U. S.),
e, f ʒj. Fatal effects have followed the empyrical administra-
f lobelia.

NITE. (*Aconitum*, U. S.)—Leaves and root of the *Aconitum*
*us*, or monkshood, a perennial herbaceous plant, growing in
ountainous parts of Europe. The root is tapering; leaves
divided; flowers of a dark-blue colour. All parts are pos-
of acrid properties, and when fresh, emit a faint narcotic
*Taste* of the leaves and root, at first bitterish and acrid,
llowed by a peculiar tingling sensation, often amounting to
ness, which extends to the soft palate.
*cts.*—Those of a sedative narcotic, or rather of a *benumber*,
it diminishes sensation, causes a feeling of numbness and
g along the extremities, muscular debility, contraction of the
but no delirium or stupor. Poisonous doses cause excessive
g and numbness of the mouth, throat and stomach, with
t vomiting, prostration, great loss of sensibility, but neither
nor convulsion. It differs from tobacco and digitalis in not
ing stupor or giddiness, as a general rule. It yields its vir-
o alcohol. Its peculiar properties depend upon an alkaline
le termed *aconitia* or *aconitina*; there is also a volatile acrid
le, besides some extractive, &c.
*itia* is a white solid substance, existing in combination with
l. It possesses all the powerful properties of the plant in a
concentrated degree. In fact, when pure, it is as subtle a
as prussic acid; though much of the alkaloid sold in the shops
hless. Its very high price forms an objection to its use.
*coholic extract* of aconite (*Extr. Aconiti Alcoholicum*, U. S.),
well prepared, forms an excellent substitute for the aconitia.
ommon extract of the Pharmacopœia (*Extractum Aconiti*,
—an inspissated juice—is not so good.
.—Internally in chronic rheumatism, gout, cancer, &c.; but
ore valuable as an external application, particularly in neu-
when applied in the form of tincture.
, of the *purest aconitia*, $\frac{1}{60}$th of a grain (Pereira); but is very

seldom used; of the *tincture of the root* (*Tinct. Aconiti Radicis*, U. S.)—a saturated tincture—5 drops three times a day; of the *tincture of the leaves* (*Tinct. Aconiti Foliorum*, U. S.), gtt. xx–xxx; of the *alcoholic extract*, ⅛th of a grain. The ointment is made by adding the aconitia to fresh lard; it is used in neuralgia.

**Hemlock.** (*Conium*, U. S.)—Leaves and seeds of the *Conium maculatum*, a biennial umbelliferous plant, a native of Europe, but naturalized in the U. S. It has a spindle-shaped root, and a smooth branching stem marked with purple-coloured spots. The leaves are compound, tripennate and bipennate. Believed to be the same plant as the *κωνειον* of the Greeks, and the *cicuta* of the Romans.

Fig. 13.



The leaves should be collected from plants growing in sunny situations, and preserved in close vessels. When well preserved they retain their green colour and narcotic odour. *Taste* bitter and nauseous. Imparts its virtues to alcohol and ether. The *seeds* are small, and have a slight odour and taste, but retain all the active properties of the plant. The active principle is an alkali named *coneia*, of a highly acrid nature, sparingly soluble in water, forming salts with the acids.

*Effects on System.*—Said by Christison, who has experimented upon it, to act as a direct sedative to the cerebro-spinal system, occasioning paralysis of the voluntary muscles, and subsequently of the muscles of respiration, together with vertigo and general debility. Its influence appears to be exerted more over the nerves of motion than over those of sensibility, producing a paralysing effect upon the muscles supplied by the former.

*Uses.*—Employed by the ancients as a discutient or resolvent, in enlargements and indurations of the glands and viscera; also in

la, bronchocele, leprosy, syphilis, and ulcers of a cancerous
ter. Its chief reputation has been in cancer, for which it
troduced into practice by Störk of Vienna; but it is highly
ɔle that its alleged virtues in this disease are solely due to
·cotic powers.
nlock is used in *powder*—dose, 3 or 4 grains two or three
a day; *tincture*—dose, fʒss to fʒj; *extract*—an inspissated
ɔf the leaves,—3 grs. two or three times a day.

DROCYANIC ACID. (*Acidum Hydrocyanicum*, U. S.)—This
a compound of hydrogen and cyanogen, and is of vegetable
, being found in the bitter almond, cherry laurel, and in most
species of the *prunus* and *amygdaleæ*. Usually obtained,
er, by decomposing the bicyanide of mercury, by hydrochloric,
drosulphuric acid. The concentrated, or purest acid, is a
. fluid of a sp. gr. of 0·697; having a strong peculiar odour,
, however, differs from that of the oil of bitter almonds; ex-
y volatile; boils at 79°; has a great tendency to undergo
position, and is extremely poisonous. It is never employed
undiluted form.

*medicinal* or *dilute* hydrocyanic acid is procured by the
ɔn of hydrochloric acid on cyanide of silver in water. Its
ties are similar to those of the concentrated acid, only in a
egree; it contains from 2 to 3 parts of real acid in 100 of
It is very liable to decomposition, especially when exposed
light; hence it should be kept in a dark place.

*cts on System.*—In very small doses, repeated, it causes a
sh taste, nausea, vertigo, faintness, but no very certain alte-
of the circulation. The more violent effects are great and
prostration, giddiness, and faintness, tetanic convulsions, and
bility, difficult and spasmodic respiration, and death. The
ır odour of the acid is usually very distinct. The post-mortem
ances are not very definite. The best *antidotes* are chlorine,
ıia, the cold affusion, and artificial respiration.

.—Internally, as a remedy in certain nervous affections, par-
ly *gastrodynia*; also in hooping-cough, asthma, epilepsy, hy-
ɔhy and palpitation of the heart, and in the cough of phthisis.
ıally, it is employed as a wash in certain forms of skin disease,
proportions being ʒij of the dilute acid to Oss distilled water.
f the officinal acid, 1 to 3 drops, repeated till some obvious
s produced.

substitute for hydrocyanic acid, the *cyanide of potassium*
used, since it is not, like the former, apt to undergo decom-
ı when kept. It may be given in the dose of ¼ gr., gradually
ed. When swallowed it becomes converted into hydrocyanic
y the acid of the stomach. Another good substitute is the
*itter almonds*—in the dose of ¼ of a drop, to be repeated.

# CLASS IX.

## ALTERATIVES.

Alteratives are medicines which, by slowly and gradually modifying the nutrition of an organ or tissue, subvert diseased action, and bring about a healthy condition.

No especial evidence of their action upon the system is afforded, except the gradual disappearance of disease, and the restoration to health.

It is highly probable that most, if not all the true alteratives act by entering into combination with the proteine principles, either of the blood, or of the tissues, forming compounds incompatible with the continuance of the morbid nutrition of the part. Now, by continuing their use for some time, the nutrition becomes completely modified; and, on discontinuing them, the tissue gradually returns to a healthy nutrition; the compounds, which had in the mean time been formed, being removed by absorption.

It can easily be understood, then, how such remedies, if pushed too far, will prove injurious by breaking down the crasis of the blood, and inducing a cachectic condition.

Some of them appear to possess the power of especially attacking morbid deposits of a proteine nature, as indurations, or thickenings from a deposit of coagulable lymph, &c.; such an action is sometimes called *liquefacient*.

**Mercury.** (*Hydrargyrum*, U. S.)—In the *metallic state*, it is not believed to act upon the system; but, when swallowed in that state, it very soon is oxidized, and then becomes efficient. The *vapour* from metallic mercury is known to be active, as is seen from its effects on artisans who work in that metal. The effects of mercury on the system may conveniently be considered under the two heads of its *alterative* and its *salivant* operation. When given in very minute doses, and continued for a length of time, it augments all the secretions, causing increased action of the mucous membranes generally; at the same time, the absorbents are stimulated to greater activity, so that under its operation, effused fluids are seen to diminish or disappear, and glandular enlargements are often dispersed. It also usually relaxes the bowels, in consequence of the augmented secretion of their mucous membrane.

In larger doses, mercury acts as a *sialogogue*, producing all the above-mentioned effects, only to a greater degree, and in addition, increased action of the salivary glands, with swelling and soreness of the gums—a train of symptoms denominated *salivation*. The signs of the mercurial sore mouth are the following: slight swelling

derness of the gums, particularly when the teeth are pressed
er; a coppery taste in the mouth; a peculiar, unpleasant
and an increased flow of saliva, which may become excessive.
this state, the fat is rapidly absorbed, the patient becoming
ted; the nervous and circulatory systems are excited, and the
when drawn, exhibits the same appearance as in inflammation.
some constitutions, mercury produces a sort of poisonous
causing great prostration, a small and frequent pulse, with a
and contracted countenance. It sometimes occasions an erup-
on the skin of a miliary character, and in some instances,
ise to profuse sweats. The remedy for these effects is pure
ir, and a tonic course of treatment.
cury produces its influence upon the system, in consequence
g absorbed, as is proved by the fact of its being detected in
of the secretions, as well as in the solids.
.—1. *As an alterative.*—In *functional disorder of the diges-
gans,* as indicated chiefly by the appearance of the stools,
are either scanty, dry, and of a clay colour, showing a defi-
of bile, or very copious, liquid, and of a bilious colour,
g a redundancy of bile;—in *constipation,* which very often
ls on a deficient hepatic secretion, or deficient secretion of the
al mucous membrane;—in *some forms of chronic cutaneous*
.—*Dose,*—as an alterative, half a grain to a grain of calo-
three grains of blue mass, every night, or every other night,
ollowed next morning with a laxative, if the bowels are con-
In acute cases, much smaller doses may be given, and more
tly repeated.
*s a sialogogue.*—In *fevers,* mercury is very useful; chiefly
ting the secretions. The proper indications for its use are a
gue, torpor of the bowels, dry skin, and scanty urine; it is an
ant remedy in typhoid fever; but here the *mildest* salivation
required. In very high grades of fever, it is almost im-
e to salivate.—In *inflammation,* it is a valuable therapeutic
acting as a true antiphlogistic or anti-plastic, preventing the
on of coagulable lymph, more particularly where the serous
anes are involved; generally, bloodletting should be premised:
ntra-indicated in inflammations of an erythematous, gangre-
alignant, or scrofulous character.—In *diseases dependent on*
*red secretion of the liver,* as dysentery, diarrhœa, ascites, &c.
*romote absorption,* as in the various forms of dropsies.—To
what has been termed its *revolutionizing effect,* in certain
diseases, especially syphilis, but only in its secondary form;
colica pictonum, in which it may be usefully combined with

contra-indicated in scrofula, phthisis, all malignant dis-
nd suppurations. *Dose,* as a salivant, half a grain to a grain

of calomel, or 3 to 5 grs. blue pill, three times a day: opium to be added, if it purge. If the stomach be irritable, the mercurial ointment may be rubbed on the insides of the arms and thighs, or applied to blistered surfaces; or fumigations with cinnabar may be resorted to.

There is a great difference in the susceptibility of different persons to the salivant action of mercury; it is much more difficult to salivate children than adults. Sometimes the medicine accumulates in the system, and breaks out with great violence.

In producing salivation, the mildest impression is all that is required; excessive salivation is always to be avoided. The treatment for it is to reduce the local inflammation by leeches and blisters, if necessary; astringent and detergent washes of alum, sugar of lead, &c., and opium internally.

Preparations of Mercury.—It is not, at present, given in the liquid form. When given in the metallic state, it is *extinguished*, by being first rubbed up with different substances, which serve to divide it very minutely, and perhaps, partially to oxidize it.

*Mercurial or Blue Pills.* (*Pilulæ Hydrargyri*, U. S.)—Made by rubbing up metallic mercury with conserve of roses and liquorice-root;—requires a long trituration. Colour, bluish; becomes darker by exposure; weight of the officinal pill, three grains. Dose, as a sialogogue, one pill, three times a day; as an alterative, one pill, every other night;—sometimes given in emulsion.

*Mercury with chalk.* (*Hydrargyrum cum Cretâ*, U. S.)—Prepared by triturating mercury with prepared chalk; colour, bluish-gray; a mild mercurial, particularly useful in the bowel-affections of children. Dose, from 1 to 10 grs., three or four times a day.

*Mercurial Ointment.* (*Unguentum Hydrargyri*, U. S.)—Sometimes called *blue ointment*; prepared by rubbing up together mercury, lard, and suet, until the mercury is extinguished; colour, bluish; becomes darker by age; used to produce the mercurial impression, by rubbing into the skin; also to blistered surfaces.

*Mercurial Plaster.* (*Emplastrum Hydrargyri*, U. S.)—Made by rubbing up mercury with melted rosin and oil, and then mixing with melted lead-plaster; used to discuss glandular swellings, &c.

*Mild Chloride of Mercury.* (*Hydrargyri Chloridum Mite*, U. S.)—Chemically, a *protochloride*; common name, *Calomel.* Made by subliming a mixture of the protosulphate of mercury and chloride of sodium; double decomposition ensues, resulting in the formation of protochloride of mercury and sulphate of soda; crystalline at first; requires to be powdered and washed in water; colour, ivory-white; no taste or smell; insoluble in water or alcohol; incompatibles, alkalies, alkaline earths, and sulphurets. Dose, as a sialogogue, gr. j, three times a day; as an alterative, gr. j, every night, y other night. *Howard's calomel* is a very fine variety, made wing the vapour to come in contact with watery vapour.

rosive *Chloride of Mercury.* (*Hydrargyri Chloridum Corro-* U. S.)—Common name, *Corrosive Sublimate*; chemically, a *ide*; made, by subliming a mixture of the bisulphate of mer- d chloride of sodium. At first, it is in white, semi-transparent ; soluble in water and alcohol; taste, metallic and styptic; isonous; best antidote is albumen; not much used inter- not so liable to salivate as calomel; externally applied, it is stic; a weak solution, or ointment, is employed in venereal roat, and cutaneous diseases.

*k Oxide of Mercury.* (*Hydrargyri Oxidum Nigrum*, U. S.) mically, a *protoxide;* made by adding calomel to lime-water, lution of potash; colour, black; used chiefly as a wash for e, in the form of *black wash.* Dose, ½ gr.

*Oxide of Mercury.* (*Hydrargyri Oxidum Rubrum*, U. S.)— cally, a *binoxide;* common name, *red precipitate;* made by the nitrate; occurs in small, shining, red crystals; never iternally; but externally, as a stimulant for old and indolent ; also, for psorophthalmia, in the form of ointment.

*de of Mercury.* (*Hydrargyri Iodidum*, U. S.)—Chemically, a *lide;* made by rubbing up mercury and iodine together with l; colour, greenish-yellow; used in secondary syphilis; dose, ain, gradually increased.

*iodide of Mercury.* (*Hydrargyri Iodidum Rubrum*, U. S.)— ed by action of corrosive sublimate on iodide of potassium; brilliant red; used as an ointment in skin diseases.

*Sulphuret of Mercury.* (*Hydrargyri Sulphuretum Rubrum*, —Common name, *Cinnabar;* found native; made by heat- gether mercury and sulphur; colour, fine red; powder is *vermilion*,—used for fumigation.

*k Sulphuret of Mercury.* (*Hydrargyri Sulphuretum Nigrum*, —Old name, *Ethiop's mineral;* prepared by rubbing sulphur iercury together in a mortar; colour, black; scarcely ever t present.

*ow Sulphate of Mercury.* (*Hydrargyri Sulphas Flavus*, —Common name, *Turpeth mineral;* made by the action of water on the bisulphate; the yellow subsulphate precipi- very little used; emetic, in the dose of 5 grains.

*ate of Mercury.* (*Hydrargyri Nitras*, U. S.)—Used only in rm of ointment,—called *citrine ointment* (*Unguent. Hydr. is*, U. S.), made by heating the fresh nitrate with lard and foot oil. This is of a fine citron colour, when first made, but by being kept; much used in skin diseases, and as a stimu- ulcers.

*Ammoniated Mercury.* (*Hydrargyrum Ammoniatum*, U. S.)—Common name, *white precipitate;* made by adding the solution of ammonia to a solution of corrosive sublimate; occurs in white masses, without odour; used only as an ointment for cutaneous diseases.

IODINE. (*Iodinium*, U. S.)—A simple, non-metallic solid, of a bluish-gray colour, and metallic lustre, with a peculiar odour; volatile; sparingly soluble in water; more so in alcohol.

*Effects on System.*—In very small doses, it acts as a general tonic, occasionally increasing the flow of urine, and sometimes producing salivation. If continued for a length of time, it stimulates the absorbents, causing emaciation. If still longer employed, it acts upon the nervous system and digestive organs. In large doses, it is a corrosive poison. Used chiefly to promote the absorption of indurations and enlargements, &c. Probably, the best remedy in goître, in which it may be employed both internally and externally. Scrofula is another disease in which iodine acts beneficially, particularly in the form of glandular swellings, ophthalmia, abscesses, &c.; also in chronic rheumatism, chronic cutaneous diseases, and tertiary syphilis. Dose, ¼ to ½ a grain, but not in substance, on account of its difficult solubility.

*Tinctura Iodinii*, U. S.—Contains ℥j of iodine to Oj alcohol; not quite saturated; when long kept, it is partially decomposed; dose, 10 to 20 drops, in sweetened water. The tincture used advantageously, externally, in lupus, erysipelas, and other skin diseases; and also in affections of the joints; to be applied by means of a small brush.

*Compound Tincture of Iodine*, (*Tinct. Iodinii Composita*, U. S.), contains ℥ss of iodine, ℥j of iodide of potassium, and Oj of alcohol.

*Iodide of Potassium.* (*Potassii Iodidum*, U. S.)—Made by mixing together iron filings and iodine with water, by which iodide of iron is formed; then decomposing with carbonate of potassa. It is in the form of white cubical crystals; somewhat deliquescent; very soluble in water and alcohol; taste, acrid and saline; its aqueous solution has the property of dissolving iodine. It acts on the system very much as iodine, though less energetically;—used in cachectic conditions, particularly in tertiary syphilis; in the various forms of scrofula, rheumatism, &c. Dose, 3 to 20 grs., three times a day. Sometimes it produces some irritation of the bowels, and vertigo.

*Lugol's Solution of Iodine.* (*Liquor Iodinii Compositus*, U. S.)—Made by dissolving ℥jss iodide of potassium and ʒvj iodine, in Oj water; dose, 6 to 30 drops, three times a day, gradually increased. This is an active and excellent preparation, much used by Lugol in the treatment of scrofula.

'e are many other preparations of iodine, more or less em- ; as the *iodide of lead; iodide of sulphur*,—used in the f an ointment, in certain cutaneous affections;—*iodide of* c.

*ne Ointment.* (*Unguentum Iodinii*, U. S.)—Made by rubbing ther iodine and lard.

*uentum Iodinii Compositum*, U. S.—Made like the other, e addition of some iodide of potassium; both are used in t scrofulous tumours.—Iodine and iodide of potassium are nes employed in the form of bath.

ENIC. (*Arsenicum*, U. S.)—Probably inert, so long as it re- s metallic state; but very active, as an oxide, or salt.

*cts.*—In very minute doses, it is tonic and alterative; but, if ed in, it causes muscular debility and general depression of tem. It acts by being absorbed into the blood, as is proved existence in the secretions. In large doses, it is a powerful ve poison. Symptoms of poisoning—pain and heat of sto- pain of throat, vomiting of acrid matters, incessant thirst, tion, and death. Antidote—the *hydrated peroxide of iron*, acts chemically, forming an insoluble arsenite of iron.—Used in intermittent diseases; will often cure intermittent fever, uinine fails; also, in chronic skin diseases, particularly of a haracter; also in nodes. Dose of arsenious acid, $\frac{1}{12}$th of a three times a day, in pill.

*ler's Solution.* (*Liquor Potassæ Arsenitis*, U. S.)—Made by together 64 grs. arsenious acid and carbonate of potassa, n f℥xij water, and then adding f℥ss spirits of lavender, to a colour. Dose, 10 drops; but often this will be found too or some constitutions.

arsenical preparations should be given on a full stomach, eir effects very carefully watched. One of the first symp- the system being brought under their influence, is an œdema eyelids, which will subsequently spread over the face.

# LOCAL REMEDIES.

## CLASS X.

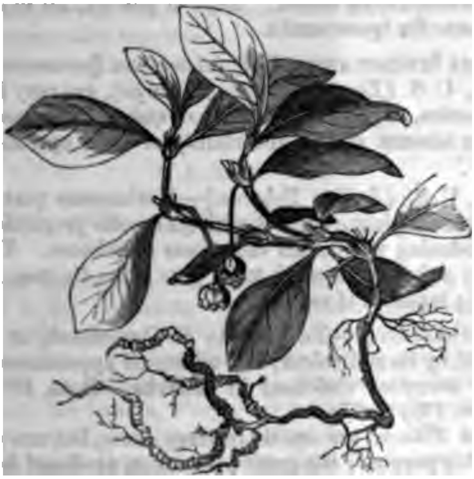
### EMETICS.

ICINES which, as an ordinary result, produce vomiting. The f an emetic is not immediate; usually from 10 to 20 minutes elapse before vomiting occurs. Emesis is partly the act of the stomach, and partly of the brain and spinal marrow; if the brain be stupified by narcotics, the stomach becomes very insusceptible to the action of emetics. Some emetics act only if *immediately* applied to the stomach; others produce their effect no matter how introduced into the system. The act of vomiting is chiefly *reflex*. If the eighth pair of nerves be cut, no vomiting is produced by emetics. The susceptibility to their influence is increased by irritation or inflammation of the stomach, and by fever; it is lessened by nervous disorders, and by narcotic poisons.

Emetics are useful to remove improper matters from the stomach, as poisons or ingesta; to deplete from the system; to promote the secretions; to produce muscular relaxation; to give a shock to the system, and thus break up morbid associations; to cause pressure on the surrounding viscera; to reduce arterial action; and to cause revulsion to the stomach. They should be avoided, if possible, in congestion of the brain, hernia, the advanced stages of pregnancy, and in inflammation of the stomach and surrounding parts.

**IPECACUANHA**, U. S.—Root of the *Cephaëlis ipecacuanha*, a perennial plant, growing in Brasil; about 5 or 6 inches high. The roots, as met with in the shops, are several inches long, contorted, of a grayish-brown colour, about the thickness of a small quill, apparently composed of a series of transverse rings, from which cause it is often called *annulated*. The cortical portion, which includes

Fig. 14.



gs, is hard, horny, and brittle, resinous in its fracture; the ıs portion is small and inert. There are three varieties, *brown*, ıd *gray*. Colour of powder, light fawn; odour, slight in The powder excites sneezing, and, in some, asthmatic ms. Water and alcohol extract its virtues; but injured by ›iling; also by exposure to the light. Active principle, an ːalled *emetia*.

.—In very small doses it is tonic and alterative; rather loses prove diaphoretic and expectorant; still larger quanti- ıse vomiting. Its emetic operation is mild, prompt, and cer- ıence it is very useful as an evacuant from the stomach. It ːn used with advantage in hemorrhage.—Dose, as an altera- to ½ gr.; as a diaphoretic, ½ to grs. ij; as an emetic, 15 to 30 ›est given in warm water.

*Vinum Ipecacuanhæ*, U. S., contains ℥j to Oj;—dose, as an f℥j,—for an adult. Used chiefly as a diaphoretic and ex- ınt.

*Syrupus Ipecacuanhæ*, U. S., is of about the same strength.

'e are several indigenous emetics, the most important of which following:

ENIA, U. S.—Root of the *G. trifoliata* and *G. stipulacea*. ometimes called *Indian physic*. It has a long, branching a reddish-brown colour. Dose of powder, 20 to 30 grs. A ıbstitute for ipecacuanha.

HORBIA IPECACUANHA, U. S. (*American Ipecacuanha*), and E. LATA, U. S. (*Large Flowering Spurge*), are very irritant and ul emetics, especially in the fresh state. They are not much 'ed on account of the uncertainty of their operation. Dose, xx.

ELIA, U. S. (*Indian Tobacco.*)—Herbaceous part of the *L.* , an annual plant. Along with its emetic properties it is also c, producing very much the effects of tobacco. Used chiefly modic asthma. Dose, 5 to 20 grs. The *tincture* is officinal; , fʒj; repeated if requisite.

GUINARIA, U. S.—Root of the *S. Canadensis*, or *blood-root;* uished by its red colour, and truncated appearance. Emetic, ghtly narcotic; also used in catarrhs. Dose, 10 to 20 grs.; ncture, fʒij to f℥ss.

*ill* and *Tobacco* are emetic in large doses, but are seldom em- for this purpose; the great prostration produced by the latter bjection.

*ard*, in powder, is a stimulant emetic; it may be used in ıses of narcotic poisoning.

### MINERAL EMETICS.

**Tartar Emetic** differs in its action, as an emetic, from ipecacuanha, in causing much more retching, nausea, and general disturbance of the system; hence employed to act upon the surrounding viscera, as in congested liver or spleen; to break up the paroxysms of intermittents; to produce relaxation in croup, and in dislocations; in nervous diseases, as in neuralgia and amaurosis. Ipecacuanha is preferable in poisoning from narcotics. Often combined with ipecacuanha. Dose, 2 or 3 grs.; best given in divided quantities, dissolved in water. Dose of *Vinum Antimonii* as an emetic, fʒj, repeated, for an adult.

**Sulphate of Zinc.**—A very prompt and powerful emetic, causing but little nausea. Chiefly used in cases of narcotic poisons,—best to combine it with ipecacuanha. Dose (medium), gr. x; in narcotic poisoning, ʒj.

**Sulphate of Copper.**—A still more powerful emetic than the last;—used also in narcotic poisoning;—sometimes in membranous croup. Medium dose, 2 or 3 grs.; in cases of poisoning by narcotics, 5 to 15 grs.;—danger of inflammation from over-doses.

The *Turpeth Mineral*, *Arsenic*, and *Corrosive Sublimate*, are each emetic in large doses, but are scarcely ever used with this intention. *Alum* is occasionally employed.

## CLASS XI.

### CATHARTICS.

**These** are medicines which evacuate the alimentary canal. They act either, 1, by increasing the peristaltic movement, or, 2, by augmenting the mucous secretions, or, 3, by stimulating the liver to throw out bile. Such cathartics as merely evacuate the intestinal contents, are termed *Laxatives*; those which produce increased secretion into the bowels, *Purgatives*; and such as cause large watery discharges, *Hydragogues*. Cathartics also differ as to the part of the canal which they affect; thus aloes chiefly acts upon the rectum; gambogc and calomel upon the upper bowels; the neutral salts upon the whole tract. Some occasion a great amount of depletion, while others, as rhubarb, produce a tonic impression. The term *drastic* is applied to such as act with great violence.

—To evacuate the bowels from noxious matters; to relieve
ation and its attendant evils; to deplete from the system; to
e absorption, in dropsies; to cause revulsion to the bowels,
larly in cerebral disorders. **They are contra-indicated in**
nation of the mucous membrane of the bowels; and should
tiously employed in typhoid fever. Their activity is in-
by the addition of small quantities of emetics and bitters.
;riping effect is best obviated by combination with aromatics
m. They act most powerfully when taken in an empty sto-
Hypercatharsis is best checked by an anodyne enema.

e are several *articles of diet* which are laxative, and may be
y employed in medicine, such as the ripe fruits in their fresh
r the same dried and stewed,—particularly peaches, prunes,
narinds. Sugar is also laxative, particularly in the form of
*ndia molasses*. *Rye* or *oatmeal mush and molasses* form an
nt article of diet in habitual costiveness, and in hemorrhoids.
is apt to disagree with the stomach of dyspeptics, on account
iability to generate an acid. *Bran* is an excellent article of
dyspepsia and constipation; believed to produce its laxative
sion by mechanical irritation; best used in the form of *bran-*
made from the unbolted flour

JING CASSIA. (*Cassia Fistula*, U. S.)—Fruit of the *C. fis-*
tree growing in the East and West Indies; consists of pods
a foot in length, containing numerous seeds surrounded with
, sweetish pulp. The *pulp* is procured by bruising the pods,
iling in water. It is a mild laxative, and forms one of the
ents in the Confection of Senna. Dose ʒj to ℥j.

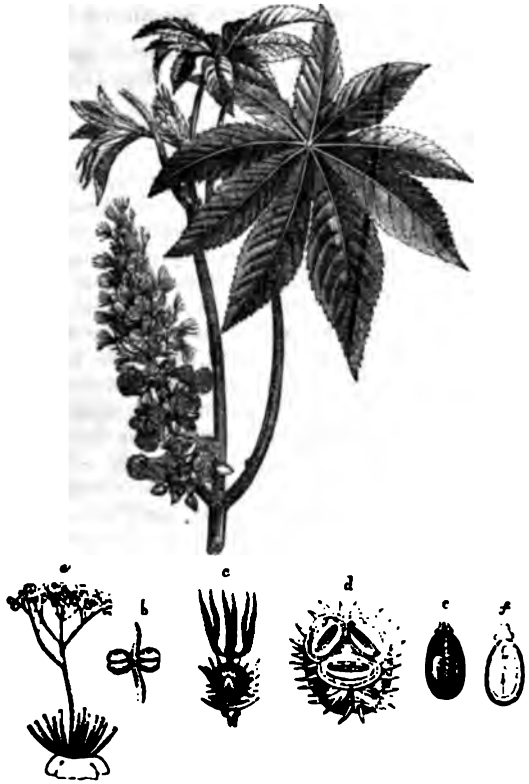
NA, U. S.—Concrete juice of the *Ornus Europæa*, a tree
g in the countries bordering the Levant. Procured both by
ieous exudation and incisions. Three varieties found in
rce. 1. *Flake Manna*, the result of spontaneous exudation;
in pieces two or three inches long, about an inch wide, bear-
marks of the bark, &c., on which it has concreted; colour,
sh-white; odour, faint; taste, sweetish. 2. *Common Manna*,
*na in sorts*, procured, when the season is more advanced, by
is; consists of particles of the flake, mixed with a fluid por-
d impurities; colour, darker; inferior. 3. *Fat Manna*, ob-
still later in the season; consists chiefly of the fluid portion,
imerous impurities; colour, much darker. Manna consists
mon sugar, united to a peculiar saccharine principle, called
*'e*.

—A mild laxative, adapted to cases of constipation, hemor-
and pregnancy; also to children. Dose ℥ss to ℥ij.

TOR OIL. (*Oleum Ricini*, U. S.)—Product of the *Ricinus*
*nis*, or Palma Christi (Fig. 15), growing in various parts of

the world. As found in the United States, it is an annual. The fruit is a three-celled capsule, each cell containing an oblong, spotted, brownish seed. The seeds are powerfully purgative, in consequence of an acrid principle which they contain, and which is dissipated by a high heat. The oil is procured either by expression or decoction. 1. *Expression*. The seeds are gently heated, and then subjected to powerful pressure; a thick, whitish oil exudes, which is boiled for some time in a large quantity of water; this dissolves out the mucilage, and coagulates the albumen; the clean oil is now removed, and boiled with a minute quantity of water, to drive off the acrid principle. 2. *Decoction*. The seeds are bruised and boiled in water; the oil rises and is skimmed off the surface, and is again boiled to remove the acrid principle; apt to have a

Fig. 15.



colour than the other. The acrid principle is thought to
; of two acids, named *ricin-oleic*, and *ricin-stearic* acids.
.—A mild and certain cathartic, intermediate in its action
n laxatives and purgatives. The more it is free from colour,
and taste, the better; soluble in cold alcohol; particularly
ble to cases of children and pregnant women; also in irri-
and inflamed bowels, colic, dysentery, and diarrhœa. Ordi-
ose f ℥j, though less will frequently operate. Infants require
er proportionate dose than adults, in consequence of their
ing it. May be given in boiling milk, hot coffee, &c.; but
the froth of porter or ale; also as an emulsion.
*seed oil* and *melted butter* may be substituted for castor oil.

UBARB. (*Rheum*, U. S.)—Root of different species of *Rheum*,
*palmatum* (Fig. 16), *R. undulatum* (Fig. 17), *R. compactum*
18), &c., growing in Tartary and other parts of Asia; also
ted in Europe. It is a perennial plant, with large branching
nd numerous large petiolate leaves.

roots, when dug up, are carefully dried, sorted, and sent to
t. Three varieties are recognised: 1. *Russian* or *Turkey*
rb. This kind is prepared with extreme care, at a frontier
between Tartary and Russia, each piece being bored down to
tre to ascertain its soundness: imported from St. Petersburg.
eces are irregularly cylindrical in shape, with angular edges,
vely yellow colour externally, variegated within; yields be-
e knife, feels gritty to the teeth, stains the saliva, and has a
and astringent taste; it is the most valuable. 2. *Chinese*
rb. Probably of similar origin with the other; shipped from
; the pieces are smooth and powdery on the outside, appear-
if rasped. Colour, not so lively; odour and taste, similar
other; the perforation extends quite through, and some-
presents the remains of the string upon which it was dried;
r in value, but much cheaper. 3. *European Rhubarb.*—
in long thin pieces, more compact; does not tinge the saliva,
l gritty to the teeth; inferior to the others as a purgative.
ive principle, *rhubarberin*,—a yellow, crystalline, volatile sub-
; contains also tannin, oxalate of lime, rheic acid, an odorous
le, colouring matter, &c. Water and alcohol extract its
; it should not be long boiled.
.—A good tonic cathartic, operating chiefly on the peristaltic
; does not deplete, and hence the best purgative in typhoid
Much used in constipation, combined with aloes and soap.
etimes gripes, in which case it may be combined with aro-
Dose, as a laxative, 5 to 10 grains; as a purgative, 20 to
ins; given in powder or pill. The following are the officinal
tions; *Infusum Rhei*, made in the proportion of ℥ij to Oj
*Tinctura Rhei*, useful in typhoid complaints; *Tinct. Rhei*

*et Aloes*, formerly called *Elixir Sacrum*; *Tinct. Rhei et Gentianæ*; *Tinct. Rhei et Sennæ*, or *Warner's Gout Cordial*; *Syrupus Rhei*; *Syrupus Rhei Aromaticus*, or *Spiced Syrup of Rhubarb*; *Syrupus Rhei et Sennæ*; *Vinum Rhei*; *Extractum Rhei*; *Extractum Rhei Fluidum*; *Pilulæ Rhei*; *Pil. Rhei Composita*.—Roasting impairs the purgative property of rhubarb, but does not affect its astringency.

Fig. 16.

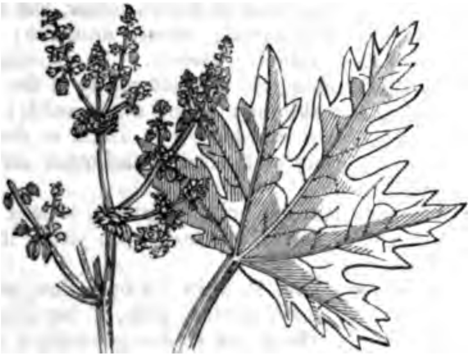


Fig. 17.

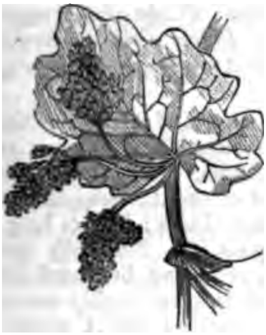
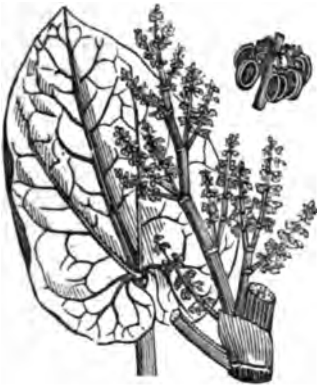


Fig. 18.



**Aloes.** (*Aloe*, U. S.)—Inspissated juice of the leaves of different species of *Aloe*, as *A. spicata*, *A. Socotrina*, and *A. vulgaris*,—succulent plants with long, narrow, toothed leaves, growing in tropical countries. The juice is procured either by draining from the leaves, by expression, or by boiling. Several varieties recognised in commerce: 1. *Cape Aloes.* Obtained from the *A. spicata*, growing at pe of Good Hope; occurs in masses of a shining, dark olive-colour, of a vitreous fracture, translucent at the edges; ·, of a greenish-yellow colour; odour, disagreeable; taste, ly and permanently bitter. 2. *Socotrine aloes*,—from the *otrina;* pieces of a yellowish-brown colour, less shining than mer; fracture conchoidal; odour, aromatic; taste, very much the most valuable variety. 3. *Barbadoes aloes*,—d in the West Indies; the product chiefly of the *A. vulgaris;* dark-brown, not shining; odour disagreeable; much used ses. 4. *Hepatic aloes*,—known in India as *Bombay aloes;* ly an inferior variety of Socotrine and other sorts; it has a ver colour.

s consists of a peculiar soluble matter, termed *aloesin*, and oluble substance called *apotheme.* It yields its virtues to and alcohol.

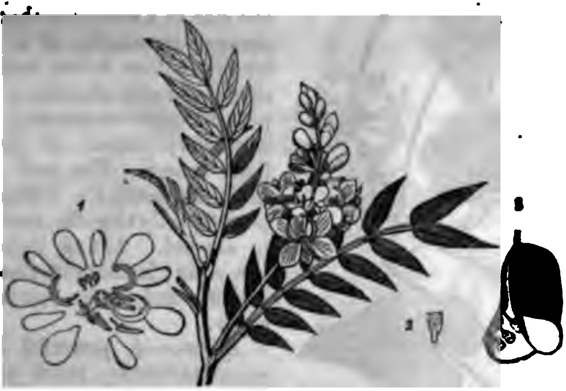
.—A warm purgative, slow in its operation, acting on the bowels; will sometimes produce piles, if too long continued; has a tendency to the pelvic viscera generally; chiefly given tipation, combined with soap, rhubarb, or colocynth. Dose, xative, 2 to 6 grs.; as a purgative, 10 to 15 grs. The offi- reparations are the following: *Pilulæ aloës et assafœtidæ*, seful in the constipation of old people; *Pilulæ aloës et myrrhæ*, *us' Pills; Pil. Rhei compositæ; Pulvis aloës et canellæ* or *icra; Tinctura aloës; Tinc. Aloes et myrhæ,* or *elixir proprie- Vinum aloes.*

NA, U. S.—Leaflets of different species of *Cassia*, as the *C. lia* (Fig. 19), *C. obovata, C. elongata, C. Æthiopica,* small growing in tropical Asia and Africa. Several commercial s: 1. *India senna,* the product of the *C. elongata,* grown bia and Africa, and thence taken to India; leaflets long and , intermingled with pieces of pods. 2. *Tinnivelly senna;* ly from the same source as the preceding, but much longer re distinct; very free from impurities, and highly esteemed. *xandria senna,* product of the *A. obovata* and *A. acutifolia,* from Upper Egypt; it contains also the leaves of the 4. *Tripoli senna,* from the *A. Æthiopica,*—seldom now n market.

true senna leaves may be recognised by their oblique lower and the inequality of their insertion into the footstalk; odour, ut peculiar; taste, sweetish and nauseous; active principle, *in.*

a is an active hydragogue cathartic; generally administered in ation with manna, or the neutral salts. *Infusion* (*Infusum Sen- S.*) made in the proportion of ℥j to Oj. Its griping tendency d by combining with aromatics, or the neutral salts.—The following preparations are officinal: *Tinctura Sennæ et Jalapæ*, or *Elixir salutis; Confectio Sennæ*, or *Lenitive electuary; Syrupus Sennæ;* and *Fluid extract of senna.*

Fig. 19.

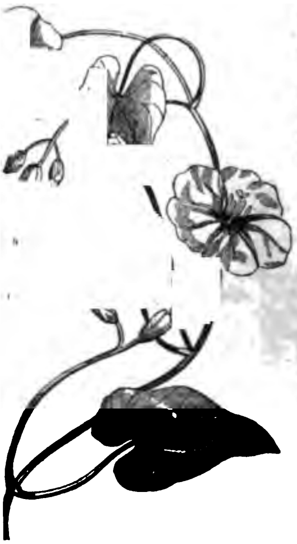


The leaflets of the *American Senna* (*Cassia Marilandica*, U. S.), an indigenous plant, possess similar properties to those of the true senna, and may be advantageously used as a purgative, in a rather larger dose.

SCAMMONY. (*Scammonium*, U. S.)—Dried juice from the root of the *Convolvulus scammonia*, a climbing plant, growing in Syria and Asia Minor. It is obtained by slicing off the root, and allowing the juice to concrete. Formerly, the commercial varieties were distinguished as *Aleppo*, *Smyrna*, and *Montpellier* scammony; at present, they are generally known under the two heads of *genuine* and *factitious*. The purest kind (seldom seen here), is denominated *virgin* or *tear scammony;* it consists of shapeless masses, rather porous, of a dull ash colour, and free from impurities. The sort usually met with is in saucer-shaped pieces, three or four inches in diameter, of a dark ash-gray colour, hard, and containing numerous adulterations. It is often common to designate the genuine drug, from whatever source procured, as *Aleppo scammony;* while the term *Smyrna scammony*, is applied to the others. The *spurious* or *factitious* scammony, is chiefly manufactured in the south of France. Odour peculiar, resembling old cheese; taste acrid and bitter; chemically, a gum-resin, the *resin* being the active portion.

*Effects.*—A drastic cathartic; over-doses cause irritation and inflammation of the bowels; seldom given alone. Dose, five to ten grs.;—an ingredient in the *Compound extract of colocynth.*

Fig. 20.



**JALAP.** (*Jalapa*, U. S.)—Tuber of the *Ipomœa Jalapa* (Fig. 20), a climbing Mexican plant. The tubers are imported either whole or sliced. They vary from the size of a walnut to that of an orange; externally, of a blackish-gray colour, heavy, hard, and of a brownish fracture; odour peculiar and nauseous; taste nauseous; colour of powder, light brown. The root is apt to be adulterated. Virtues imparted partly to water, and partly to alcohol. Active ingredient is a resin; it contains also much starch, and some gum and sugar.

*Effects.*—A powerful hydragogue cathartic; much used in dropsies and chronic affections of the joints, particularly in combination with cream of tartar. Dose, 15 to 30 grs.; dose
mel and jalap, 10 grs. of each,—used in bilious complaints;
jalap and crem. tartar, 10 to 20 grs. of the former, and 2 to
ms of the latter.

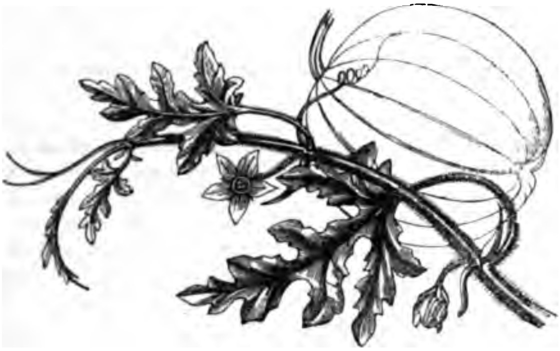
*Resin of Jalap* is the alcoholic extract: dose, 8 to 10 grs.
*t of Jalap* is used in doses of 10 to 20 grs.; the *tincture* is
icinal. The *Pulvis Jalapæ Compositus*, U. S., is a mixture
part of jalap and two parts of cream of tartar.

MAY APPLE (*Podophyllum peltatum*, U. S.), an indigenous
ial plant, possesses very similar medical properties to those
p. The root, which is the part used, is very long and
ing, of a brownish colour externally. It contains a peculiar
le—*podophyllin*. It may be employed in the same cases as
Dose, the same. The *extract* is officinal.

OCYNTH. (*Colocynthis*, U. S.)—Fruit of the *Citrullus colocyn-*
*Bitter cucumber*, a vine resembling the common cucumber,
g in the South of Europe, Asia, and Africa. Fruit about the
l shape of an orange; has a yellow rind, and a white, light, and
pulp, containing numerous seeds. As found in the shops, it is
divested of the rind. Taste, extremely bitter; virtues to
nd alcohol; the infusion gelatinizes on cooling in consequence
*ectin* contained; active principle, *colocynthin*.

*Effects.*—A powerful hydragogue, producing in over-doses inflammation of the bowels Not much used alone.—Dose, 5 to 10 grs.

Fig. 21.



The *compound extract* (*Extractum Colocynthidis Compositum*, U. S.), is an excellent cathartic; it contains colocynth, aloes, scammony, soap, and cardamoms;—dose, 10 to 15 grs.

**Black Hellebore.** (*Helleborus*, U. S.)—Root of the *Helleborus niger*, growing in the southeast part of Europe. Sometimes called the *Christmas rose.*' The root, as found in the shops, consists of a knotted caudex, from which proceed numerous black fibres, smooth and brittle; odour, slight; taste, bitter and nauseous; becomes much feebler by being kept; virtues to alcohol and water.

*Effects.*—A drastic hydragogue, also emmenagogue; much used by the ancients in mania; not so much employed at present. It is sometimes named *Melampodium*. Dose, 10 to 20 grs.;—of the *tincture* (*Tinc. Hellebori*, U. S.) f℥j; of the *extract* (*Extractum Hellebori*, U. S.) gr. iij–v.

**Gamboge.** (*Gambogia*, U. S.)—Inspissated juice of the *Hebradendron cambogioides*, a native of Ceylon and Siam. The juice is procured by breaking off the leaves and young shoots; at first it is of a yellow colour, but becomes a dark orange by hardening. Usually found in cylindrical pieces, many of which are hollow. Fracture glossy; colour of powder, bright yellow; no odour, and but slight taste; forms with alcohol a golden-coloured tincture, and with water a yellow turbid emulsion.

*Effects.*—A powerful drastic cathartic; over-doses dangerous. Dose, 3 to 6 grs., usually given in dropsy, combined with cream of tartar; also in tape-worm.

*Compound Cathartic Pill.* (*Pilulæ Catharticæ Compositæ*, U. S.)

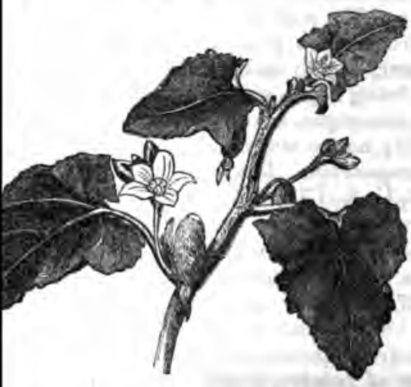
admirable compound cathartic, containing calomel, scam-, gamboge, colocynth, aloes, and jalap; dose for an adult, three

ɔTON OIL. (*Oleum Tiglii*, U. S.)—Derived from the seeds *Croton tiglii*, a small tree growing in the East Indies. The procured by first roasting the seeds and then subjecting them ssure. As first obtained it is nearly colourless; but as found shops, it has a yellowish-red hue; odour, faint and peculiar; acrid and burning; partially soluble in alcohol, which sepa-it into its constituent portions; of these, the acrid principle, *crotonic acid*, is soluble, while the true oil, which is a mild oil, is not soluble. Most liable to be adulterated with castor raud detected by the solubility of the latter in alcohol.

*ects.*—One of the most powerful drastic cathartics; over-doses langerous; applicable in obstinate constipation, and in coma; tage from the smallness of the dose. Dose, 1 to 3 drops, best in form of pill made up with crumb of bread, each con-g half a drop. Applied externally, it produces a pustular ion, and may be used as a revulsive, in diseases of the chest, it should be mixed with olive oil. Its external irritant effect much in different persons.

ATERIUM, U. S.—Product of the *Momordica elaterium*, or *squirting cucumber* (Figure 22), a vine growing in the South of Europe. The fruit is about the size of a lime, oval, of a greenish colour, and covered with numerous prickles. When ripe it bursts, projecting its contents. Elaterium is procured by slicing the fruit, and the juice allowed slowly to drain away upon a muslin sieve, when it gradually deposits the medicine. This is in small flattish , of a grayish-green colour, light and friable; has no odour, bitter and nauseous taste; active ingredient, *elaterin.*

Fig. 22.



*cts.*—Probably the most active of all cathartics. Used chiefly tinate dropsy. Dose of the purest (Clutterbuck's), $\frac{1}{8}$ gr.; of the commercial, ½ gr.; dose of *elaterin*, $\frac{1}{16}$ to $\frac{1}{12}$ gr. Always best to commence with very small doses, from the uncertainty of the preparation.

### MINERAL CATHARTICS.

**SULPHUR**, U. S.—Used in medicine in the form of *flowers of sulphur*, or common sublimed sulphur washed in water (*Sulphur Lotum*, U. S.) Odour and taste slight; insoluble in water, and nearly so in alcohol; soluble in oils.

*Effects.*—A mild laxative, but slow in its operation, sometimes griping; it has a decided tendency to the skin, and is thought to act on the bronchial mucous membrane. It is used in constipation attended with piles, in combination with cream of tartar; also, in dyspepsia, chronic rheumatism, chronic catarrhs, and cutaneous eruptions. Dose as a laxative, ʒj to ʒij. Externally, an excellent remedy for scabies, in the form of *sulphur ointment*; also, in the form of vapour and bath. The bath is best in the form of the natural sulphur waters.

*Sulphur Præcipitatum*, U. S., *lac sulphuris*, *milk of sulphur*—made by boiling together sulphur and lime, and then adding muriatic acid, which precipitates the sulphur in the form of a hydrate; colour, nearly white, but darkens by exposure. It has no advantage over the other form.

**CALOMEL.**—As a cathartic, it is indicated in cases where the liver is deficient in action, or is secreting vitiated bile. It is slow in its operation, requiring six or eight hours. It is apt to produce nausea and griping some time after being taken, which are no doubt owing to the bile poured out. It is believed to act by being absorbed directly into the vena porta, and so finding its way into the liver. Ordinary dose, 5 to 15 grains, but best to combine it with other purgatives, as rhubarb or jalap. There is a great difference in the susceptibility of different persons to its action. It is one of the ingredients in the *Compound Cathartic Pills*.

**MAGNESIA.**—Sometimes called *calcined magnesia*, and *magnesia usta*. Procured by exposing the carbonate to a red heat. A very light white powder; its degree of levity, however, depends upon its amount of trituration, its density being increased by that process. In this way the magnesia of Henry, Husband, &c., is made; almost insoluble in water.

*Effects.*—A mild and useful cathartic, particularly when there is acidity in the primæ viæ. Its cathartic operation is somewhat uncertain, depending upon the presence of an acid: it sometimes accumulates in the bowels. It is also used in sick headaches, and in nephritic complaints; also, in bowel-complaints, combined with rhubarb. Dose ʒj;—best given rubbed up in syrup.

BONATE OF MAGNESIA. (***Magnesiæ Carbonas*, U. S.)—Pre-**
ɔy decomposing any soluble **salt of magnesia by an alkaline**
ıte. Occurs in white cakes, extremely **light and porous; in-**
in pure water; somewhat soluble in **carbonic acid water.**
*ts.*—A gentle laxative, but **dependent for its operation on the**
und in the stomach and bowels; **apt to occasion flatulence**
ıe escape of the carbonic acid. **Dose, ʒj to ʒij.**

### SALINE CATHARTICS.

ly all are of mineral origin. They closely **resemble each**
ı their operation upon the system, producing **watery evacua-**
rom their influence over the secretory **vessels of the mucous**
ane. They are likewise **refrigerant, and are hence peculiarly**
l to febrile and inflammatory **complaints, but are contra-indi-**
ı typhoid disorders.

JTION OF CITRATE OF MAGNESIA. (*Liquor Magnesiæ Citra-*
S.)—Made by adding carbonate of magnesia to a solution of
cid and syrup; to be put into a strong bottle and corked be-
fervescence has ceased. It is a very agreeable cathartic.
℥ij–viij.

ɔM SALTS. (*Magnesiæ Sulphas*, U. S.)—Procured from the
of sea-water after the crystallization of the chloride of so-
A better method is by the action of sulphuric acid on **mag-**
also from springs. As usually found, the crystals **are small**
ədle-shaped; contain 50 per cent. of water of **crystallization;**
ce slowly; very soluble in **water; taste bitter and saline;**
nes contains sulphate of **soda as an impurity. One of the**
ıline cathartics, and very extensively employed. **Dose for**
lt ℥j; best given in carbonic acid water.

UBER'S SALTS. (*Sodæ Sulphas*, U. S.)—Procured as the
.m after making muriatic acid; also from the bittern of **sea-**
Occurs in four-sided crystals; efflorescent; contain more
) per cent. water of crystallization; more soluble at 90° **than**
taste, very nauseous and bitter; not so much used as **Epsom**
–dose about the same.

ƤHATE OF POTASH. (*Potassæ Sulphas*, U. S.)—Formerly called
*ted tartar;* the residuum after the manufacture of nitric
om sulphuric acid on nitre; contains no **water of crystalliza-**
ccurs in small, white, and very hard **prismatic crystals; not**
luble; not much used as a cathartic, **but chiefly in the pre-**
n of Dover's powder. **Dose, ℥ss.**

TRATE OF POTASSA. (***Potassæ Tartras*, U. S.)—Formerly**
*oluble tartar.* Prepared **by adding cream of tartar to a hot**
ı of carbonate of **potassa. The crystals contain no water of**

crystallization; they are deliquescent, have a cooling bitterish taste, and are very soluble in water;—not much used at present. Dose, ℥ss to ℥j.

CREAM OF TARTAR. (*Potassæ Bitartras*, U. S.)—Exists in the juice of grapes, from which it is deposited during the vinous fermentation, because it is insoluble in alcohol. It incrusts the sides of the wine casks, and is detached in the form of thick cakes of a reddish-gray colour, and sold under the name of *argol*. This, when properly purified, assumes the form of white transparent crystals of pure cream of tartar. It is generally kept powdered. Taste, acid; soluble in sixty parts of cold water, and in fifteen of boiling water.

*Effects.*—A hydragogue cathartic; also diuretic and refrigerant. Very useful in dropsy; much employed, in combination with jalap, in chronic affections of the joints; and with sulphur in hemorrhoids. Best given in sweetened water, or as an electuary with molasses;—dose, ℥ss to ℥j.

ROCHELLE SALTS. (*Sodæ et Potassæ Tartras*, U. S.)—Made by adding carbonate of soda to cream of tartar. Occurs in large, white, transparent, prismatic crystals of unequal sides; efflorescent; very soluble in water; taste less unpleasant than most of the others. It is one of the best of the saline cathartics. Dose ℥j to ℥iss.

The *Seidlitz powders* consist of a mixture of ʒij Rochelle salts, and ℈ij bicarbonate of soda in one paper, and 35 grs. tartaric acid in another paper; each paper to be dissolved in a separate tumbler, and the two mixed, when effervescence occurs from the escape of carbonic acid, and the patient swallows a mixture of Rochelle salts and tartrate of soda.

PHOSPHATE OF SODA. (*Sodæ Phosphas*, U. S.)—Prepared by the action of sulphuric acid on bone earth, which consists of carbonate and phosphate of lime; sulphate of lime is thrown down, and superphosphate of lime remains in solution; this is now to be decomposed by carbonate of soda. Occurs in large, rhombic, transparent crystals; very efflorescent; contain more than 50 per cent. of water of crystallization; taste resembles that of common salt; soluble in water;—dose, ℥j to ℥ij. Particularly applicable to cases of children, but not much used on account of its expense.

## ENEMATA.

Purgative injections are very useful, particularly to act on the lower bowels, and when there is irritability or inflammation of the stomach. The common *laxative enema* is composed of a table-spoonful of salt, molasses, and lard, each, with a pint of warm water; it may be rendered more active by the addition of castor oil, or the ı of senna. Turpentine and assafœtida are useful in tympa- Cold water alone is frequently employed in constipation. quantities of warm water are useful, by the mere distension ɜd.

## CLASS XII.

### DIURETICS.

ᴚETICS are medicines which increase the secretion of urine. ıction is much influenced by the external temperature, being ed by cold, and diminished by heat. The two functions of n and kidneys are opposed one to the other,—whatever favours cretion interfering with the other, and *vice versâ*. Their is also influenced by that of the bowels; free catharsis being opposed to diuresis.

'etics may act, 1, either by being absorbed and coming into ɔontact with the kidneys; 2, by promoting absorption into the 'essels; 3, by a stimulating impression on the mucous mem- of the urinary passages. Sometimes stimulant and tonic ı prove diuretic by the increased quantity of blood sent to lneys in a given time; certain mental emotions have also a ul effect, as fear and anxiety.

y are used chiefly in dropsies, and in inflammations and irri- of the urinary organs, after proper depletion. As a class, ɾe rather uncertain in their action.

:etics may be divided into several classes, as the Saline, Alka- .crid, and Sedative. Dr. Golding Bird makes two divisions, *l hydragogues*, or such as merely increase the watery portion urine, and *renal depurants*, or those which increase the solid uents of the urine; the latter include the saline and alkaline cs.

#### SALINE DIURETICS.

AM OF TARTAR. (*Potassæ Bitartras*, U. S.)—Exists in various ble juices, particularly that of the grape. Procured from ısks during the vinous fermentation; the salt being insoluble hol, is gradually deposited as a crust on the sides of the cask. ɔrude form it constitutes the *argol* of the shops, of a reddish Purified by repeated solutions. When pure, it is perfectly crystalline, has an acid taste, more soluble in hot than cold It is an excellent hydragogue cathartic, and also diuretic.

Well adapted to dropsies of an inflammatory type, from its possessing refrigerant properties. Should be given in a large quantity of cool water. Dose, ℥j to ℥ij daily.

**Acetate of Potassa.** (*Potassæ Acetas*, U. S.)—Prepared by action of distilled vinegar on carbonate of potassa. Very deliquescent, soluble in water and alcohol; formerly named *sal diureticus*; acts as a cathartic in large doses; produces diuresis in doses of ℈j to ʒj, every two or three hours, in a large quantity of water; used as the former.

**Nitrate of Potassa.**—Already spoken of under the head of refrigerants. Sometimes powerfully diuretic, especially when the surface is kept cool: used in the same cases as the two former. Dose, 10 to 20 grains, repeated, so that from ʒj to ʒij may be taken in twenty-four hours.

### ALKALINE DIURETICS.

**Carbonate of Potassa.** (*Potassæ Carbonas*, U. S.)—Prepared from pearlash by dissolving in cold water, filtering, and evaporating, at the same time stirring so as to cause it to granulate, the object of which is to expose as small a surface as possible to the air, and thereby prevent deliquescence. It contains impurities, as the silicate, sulphate, and muriate of potassa.

The purest carbonate, called *salt of tartar*, is made by heating two parts of cream of tartar with one of nitre.

Occurs in the form of small, white globules, of a nauseous, alkaline taste. It is a decided diuretic; used chiefly as an adjuvant, in dropsy accompanied with acidity of stomach; also as an antilithic in gravel. Dose, 10 to 20 grains, three or four times a day; may be given in carbonic acid water.

The *bicarbonate* (*Potassæ Bicarbonas*, U. S.) is prepared by passing carbonic acid through a solution of the carbonate. Occurs in white, flat prisms; inodorous; not so soluble as the carbonate.

*Uses.*—Same as the carbonate, but preferable on account of its more agreeable taste. Dose, ʒss to ʒj, repeated.

### STIMULANT DIURETICS.

**Squill.** (*Scilla*, U. S.)—Bulb of the *Scilla maritima*, a plant growing upon the shores of the Mediterranean Sea. It is a perennial plant, having a large, pyriform bulb, from which spring long, shining green leaves, and a single long flower-stem. There are two varieties, the *white* and the *red*; but they are similar in properties. The bulb is sometimes imported whole, but generally in transverse or longitudinal slices; of a yellowish-white colour; contorted; tough; of a feeble odour, and a bitter, nauseous taste. Im-

s virtues to alcohol, water, and vinegar. Contains a peculiar
le called *scillitin*.
*ts*.—In moderate doses, stimulant to most of the secretions,
larly the kidneys and lungs. In large doses, it is emeto-
ic. Much used in dropsies of an enfeebled character. Often
geously combined with calomel, and sometimes with digi-
Dose, 1 to 3 grs., two or three times a day, gradually in-
till some obvious effect is produced. As a diuretic, it is
given in form of pill or powder. The *preparations* of squill
iced under the head of *Expectorants*.

DOW SAFFRON. (*Colchicum*, U. S.)—*Bulb* and *seeds* of the
*um autumnale*; a native of Europe; grows about 6 or 7 inches
Bulb about the size of a chestnut, covered with a brownish
ane; internally, solid, white, and fleshy. It should be ga-
in July or August. Sometimes the bulb is dried whole, but
lly it is cut into transverse slices about an eighth of an inch
whitish, inodorous, of a bitter and acrid taste. The pieces
each have a notch on one side. Apt to be spoiled in keep-
ence very uncertain, as found in the shops. The seeds are
of a reddish-brown colour and of a bitter, acrid taste; the
reside in the outer coating. The seeds contain all the vir-
the bulb, and are less apt to be injured by keeping. It con-
peculiar alkaline crystalline principle, called *colchicina*, not
al with veratria, as was at one time supposed. The virtues
st imparted to wine and vinegar.
*cts*.—Stimulant to most of the secretions; rather reduces the
of the heart and arteries; seems also to influence the nervous
. In very large doses it is irritant to the stomach and
. It is chiefly used in gout and rheumatism, in which it may
bined with saline cathartics and antacids. *Scudamore's Mix-*
nsists of a draught containing 15 to 20 grs. magnesia, ʒj to
ph. magnesia, and fʒj to fʒij vinegar of colchicum. Dose
bulb or seeds, gr. j–iij,—rarely used.
*um Colchici Radicis*, U. S.—Contains half a pound of the
l bulb in a pint of wine; colour, dark reddish-brown; dose,
ps up to fʒj, gradually increased.
*um Colchici Seminis*, U. S.—Is made by macerating ʒij
l seeds in a pint of wine for 14 days; dose, the same.
*um Colchici*, U. S. (*Vinegar of Colchicum*),—made by ma-
g the bulb in vinegar, then adding alcohol. Dose, gtt. xx.

*tura Colchici Seminis*, U. S.—Dose, same as the above.
*actum Colchici Aceticum*, U. S.—A good preparation. Dose,
j, three or four times a day.
*White Hellebore of Europe* (*Veratrum album*), and the *Green*

*Hellebore of the U. S.* (*Veratrum viride*), are analogous in their properties to colchicum. Both depend for their activity upon a powerful alkaline principle called *veratria*. Veratria is occasionally employed externally in the form of ointment, in cases of neuralgia. It is a violent acrid poison; even its external application is attended with a burning, tingling sensation.

The *ointment* is made by rubbing up 10 or 20 grs. with an ounce of lard. The dose of veratria is the twelfth to the sixth of a grain.

**Turpentine.** (*Terebinthina*, U. S.)—Juice of different species of the *Pinus*, *Abies*, and *Larix*. Many varieties of turpentine are known in commerce, but only two are used in the United States.

1. *White Turpentine* (*Terebinthina*, U. S.)—Derived chiefly from the *Pinus palustris*, or long-leaved pine of the South. Grows from 60 to 70 feet high; the leaves are in threes, about a foot in length. The turpentine is collected by making incisions in the trunk of the tree in spring, when the juice exudes, and is collected in barrels. It hardens on exposure. Colour, yellowish-white; odour, peculiar; taste, hot, bitter and pungent, depending on the volatile oil.

2. *Canada Turpentine* (*Terebinthina Canadensis*, U. S.)—Sometimes called *Balsam of Fir*, and *Canada Balsam*; product of the *Abies balsamea*, or *Balm of Gilead*; found in vesicles under the bark. It is a transparent, yellow, thick liquid; odour, terebinthinate and aromatic; taste, same as the former.—All the turpentines are inflammable, scarcely soluble in water, soluble in alcohol; chemical composition, a resin and a volatile oil.

*Uses.*—In chronic rheumatism, and chronic disorders of the urinary organs; also, externally, as stimulants to indolent ulcers. Dose, gr. x to ʒj. Sometimes given by enema.

The *oil of turpentine*, already alluded to under the head of Arterial Stimulants, is more frequently employed as a diuretic in chronic nephritic complaints; dose, 10 to 20 drops.

*Tar* (*Pix Liquida*, U. S.)—Procured chiefly from the *Pinus palustris* of North Carolina, by the slow combustion of the wood arranged in large piles. It is an empyreumatic product, consisting of a resin held in solution by acetic acid and empyreumatic oil, and coloured by charcoal: slightly soluble in water; more so in alcohol and ether. The aqueous solution—*tar water*—is used in chronic pectoral complaints. The *vapour* of tar is employed for the same affections, by inhalation.—Dose, internally, ℥ss to ℥j.

The *ointment* of tar is officinal;—used in tinea capitis.

*Pitch* is the residue after the volatile parts are driven off from tar;—used in plasters.

*Creasote* (*Creasotum*, U. S.)—Is one of the ingredients in the volatile oil of tar. Colourless when pure, of an oily aspect, very

; odour, strong, peculiar, and empyreumatic; taste, hot and slightly soluble in water; much more so in alcohol. *Uses.*—tic, styptic; employed in sickness of stomach and in hæma-; dose, 1 drop every half hour, or hour. Used externally as lant; also in the form of ointment.

*(Resina,* U. S.)—The residue after the distillation of the rpentine; two varieties—the *yellow* and *white.*

—Chiefly to form plasters.

*Cerate—Basilicon Ointment (Ceratum Resinæ,* U. S.)—ellent stimulant application to ulcers arising from burns.

*lastrum Resinæ,* U. S. (*Adhesive Plaster.*)

IVA. (*Copaiba,* U. S.)—Product of the *Copaifera officinalis,* of South America. Procured by making *incisions* in the As it flows first, it is clear, but becomes thick and dark by re; colour, orange-red; odour, peculiar and strong; taste, bitter; insoluble in water, soluble in alcohol. Chemically, a oil and an acid resin called *copaivic acid;* virtues depend on which may be separated by distillation. Copaiva will soli-exposed to the air in thin layers; also if rubbed up with ia.

—A stimulant diuretic, sometimes producing nausea and g; acts also upon the mucous membranes generally. Em-chiefly in gonorrhœa, before or after the inflammatory symp-lso in chronic dysentery, and chronic bronchitis.

, 10 drops to ʒss, 3 times a day; of the volatile oil (*Oleum æ,* U. S.), 5 to 10 drops. Copaiva is often given in the form of s.

*læ Copaibæ,* U. S., are made by rubbing up copaiva with ia. Dose, gr. x–xx.

THARIDES. (*Cantharis,* U. S.)—History, &c., described he head of *Epispastics.* As a diuretic it is more stimulating e preceding, being apt to irritate the urinary organs, and strangury. Used chiefly in chronic disorders of the urino-organs, as chronic gonorrhœa and leucorrhœa, incontinence ention of urine, spermatorrhœa, and amenorrhœa; also in ob-skin diseases. Dose, gr. j, two or three times a day; gene-ven in the form of *tincture* (*Tinct. Cantharidis,* U. S.),—drops, gradually increased till some obvious effect is pro-

## MILDER DIURETICS.

PER BERRIES. (*Juniperus,* U. S.)—Fruit of the *Juniperus is,* an evergreen shrub, growing in both continents;—about of a pea, globular, of a dark-purple colour, glaucous and shrivelled. Imported chiefly from Trieste. Odour, aromatic; taste, sweetish, warm, and terebinthinate; virtues depend on a volatile oil, and are yielded to water and alcohol.

*Effects.*—A good, moderately stimulant diuretic and carminative; used chiefly as an adjuvant;—with cream of tartar, as a drink, in dropsy. The *infusion* contains ℥j of the bruised seeds to Oj of water. Dose of the *oil* (*Oleum Juniperi,* U. S.), 5 to 15 drops, several times a day.—*Spiritus Juniperi Compositus,* U. S., is an alcoholic solution of the oils of juniper, caraway, and fennel.—The tops are also occasionally used in medicine.

**Indian Hemp.** (*Apocynum Cannabinum,* U. S.)—Root of the *A. cannabinum,* an indigenous, herbaceous plant, emitting a milky juice when wounded. Odour, strong; taste, bitter and nauseous; virtues to water and alcohol. In full doses acts as an emeto-cathartic; occasionally a very powerful diuretic in some cases of dropsy. Dose of the decoction (℥ss in Oiij water, boiled down to Oj), f℥j to fʒij, three times a day.

**Dandelion.** (*Taraxacum,* U. S.)—Root of the *Leontodon taraxacum,* an herbaceous, perennial plant. The root is spindle-shaped, several inches long, of a brownish colour externally, lighter within; all parts abound in a milky, bitterish juice, particularly the root, which is more powerful in the fresh state.

*Effects.*—Tonic, diuretic, and laxative; believed to have a specific influence over the liver; used in dyspepsia attended with derangement of the liver; and in certain forms of dropsy.

*Infusion.* (*Infusum Taraxaci,* U. S.)—℥j of the fresh, or ʒij of the dried root, in Oj water;—dose, f℥ij several times a day.

*Extract.* (*Extractum Taraxaci,* U. S.)—Prepared by bruising the fresh root, straining, and evaporating;—dose, 20 to 30 grs.

**Fleabane.** (*Erigeron,* U. S.)—Herbaceous parts of the *E. heterophyllum,* and *E. Philadelphicum,* indigenous plants. They are gently diuretic, and are chiefly employed as adjuvants in dropsy, and in chronic nephritic disorders. Best given in decoction, (℥j to Oj water,)—the whole to be taken in the course of the day.

**Wild Carrot.** (*Carota,* U. S.)—Seed of the *Daucus carota,* an indigenous, perennial plant. The flowers are in umbels, which are flat at first, but afterwards contract so as to form a cup. The seeds are brownish, of an oval shape, with stiff hairs attached. Odour, slight; taste, aromatic and bitter; contain a volatile oil, which may be separated by distillation.

*Effects.*—A moderately stimulant diuretic; used as an adjuvant in dropsy, in the form of infusion.

The garden carrot has similar properties, though feebler. It is sometimes used, grated, as a poultice.

**Parsley Root.** (*Petroselinum.*)—Has also diuretic properties;

ıe is true of *Horseradish* and *Mustard.* Sometimes an infu-
several of these is given, in cases of dropsy of an enfeebled
er.

ET SPIRITS OF NITRE. (*Spiritus Ætheris Nitrici,* U. S.)—
:d by the action of sulphuric acid on alcohol and nitrate of
, by distillation; chemically, the hyponitrite of ethyl, dis-
in alcohol.
.—Colourless, limpid, of an ethereal odour, and a pungent,
h taste; apt to deteriorate when kept, becoming acid; soluble
ıol and water; apt to be impure, as found in the shops. It
horetic, diuretic, and antispasmodic; much used in fevers
ervous irritability, especially for children. Dose, 20 drops
every 2 or 3 hours.

only *sedative* diuretic much employed is *Digitalis.* It does
ceed so well in dropsies attended with much plethora, as in
f a relaxed debilitated character. It is useful in cases accom-
with albuminous urine. Its diuretic powers are increased by
ing it with squill and calomel. It is not very speedy in its
on, generally requiring several days to produce its diuretic
Dose of powder, one grain twice a day; of the tincture, 10
of the infusion, f℥ss.

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## CLASS XIII.

### DIAPHORETICS.

PHORETICS are medicines which increase the function of per-
on. The name *sudorifics* is often applied to such as increase
ısible perspiration or *sweat.* They act in different ways: (1)
ıxing the surface; (2) by direct stimulation of the sudorife-
lands; (3) by stimulating the system generally; (4) by sym-
from the stomach; (5) by filling the blood-vessels. As a class
licines, their action is not very certain, depending a good deal
he state of the system at the time, and also upon the tempe-
and hygrometric condition of the atmosphere. They are use-
evacuants, promoting at the same time absorption; they also
:e revulsion to the surface. Diaphoretics may be divided into
*frigerant,* the *nauseating,* and the *alterative.*

## REFRIGERANT DIAPHORETICS.

**Citrate of Potassa.** (*Potassæ Citras*, U. S.)—Prepared by action of citric acid, or lemon-juice, on carbonate or bicarbonate of potassa. A white, soluble, deliquescent salt; used as a diaphoretic in fevers, particularly in the forms of *neutral mixture* and *effervescing draught.*

*Neutral Mixture.* (*Solutio Potassæ Citratis*, U. S.)—Prepared by saturating lemon-juice (or an ounce of citric acid, rubbed up with four minims of oil of lemons, and dissolved in a pint of water), with carbonate, or preferably, the *bicarbonate* of potash, and filtering. Dose, a tablespoonful every hour or two: this quantity contains 15 grains of the salt.

The *effervescing draught* is the same, given in a state of effervescence. It is made by dissolving ʒij of the carbonate, or ʒiij of the bicarbonate in f℥iv water; then add a tablespoonful of this solution, mixed with the same quantity of water, to a tablespoonful of sweetened lemon-juice, or citric acid solution. Laudanum, in small quantities, may be added, if it produces griping.

**Spirit of Mindererus.** (*Liquor Ammoniæ Acetatis*, U. S.)—Prepared by the action of distilled vinegar on carbonate of ammonia. A limpid, colourless liquid, when properly made; taste, cooling and bitterish; an excellent diaphoretic in fevers. Dose, a tablespoonful every hour or two.

**Nitrate of Potassa,**—already spoken of as a refrigerant. It will frequently produce diaphoresis, especially if combined with other medicines of this sort; the *Nitrous Powders* are a combination of tartar emetic, nitre, and calomel. Nitre and tartar emetic are often prescribed, as a diaphoretic, in solution.

## NAUSEATING DIAPHORETICS.

The Nauseating Diaphoretics comprise such medicines as produce diaphoresis, by relaxing the cutaneous capillaries; in this way, nearly all emetic substances will promote perspiration, if given in small doses. The only ones much employed are, Ipecacuanha and Tartar emetic. They are indicated in all cases of high arterial excitement, not attended with irritation or inflammation of the stomach.

*Tartar emetic* is usually given in the dose of the sixth to the twelfth of a grain. *Ipecacuanha* is chiefly used as a diaphoretic, in combination with opium, in the form of *Dover's Powder*—(*Pulvis Ipecac. et Opii*, U. S.)—This is made by rubbing up one part of ipecac. and opium each, with eight parts of sulphate of potassa; the dose is 10 grains. It is a very useful anodyne diaphoretic, in rheumatism, diarrhœa, and dysentery; also in pneumonia and bronchitis, after proper depletion; it should not be used, if there be much arterial excitement, or determination to the head

## [illegible] DIAPHORETICS.

[illegible] diaphoretics are [illegible] Mezereon. [illegible]

[illegible] the root of the Sassafras [illegible] in irregular fragments, [illegible] reddish [illegible] very aromatic odour and taste. [illegible] a mild stimulant diaphoretic, and [illegible] seldom employed alone, but [illegible] other medicines. It is one of the ingre- [illegible] decoction of sarsaparilla.

[illegible] Sassafras Medulla. [illegible] is procured from [illegible] cylindrical pieces, white, and very light [illegible] The mucilage is made [illegible] boiling water; it is a very pleasant applica- [illegible] inflamed surfaces, as in ophthalmia, erysipelas.

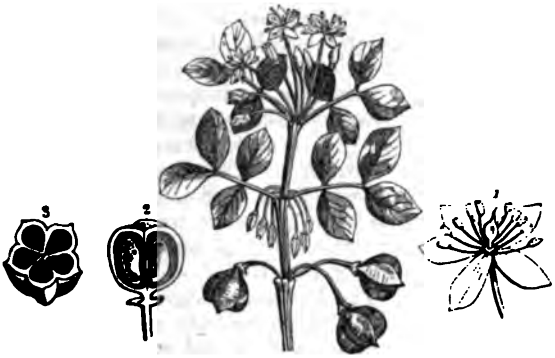
[illegible]—Product of several species of the [illegible] a shrub three or four feet [illegible] The bark of the root is the part directed [illegible] the bark derived from the branches is [illegible] comes in strips three or four feet [illegible] covered externally [illegible] tough and pliable. [illegible] its properties to [illegible] a peculiar principle called *daphnin*. [illegible] its activity depends on an acrid [illegible] applied to the skin will produce vesication. [illegible] made from the bark is [illegible] discharge from blisters.

[illegible] alterative diaphoretic; if directed to the [illegible] the kidneys. Used chiefly in combination [illegible] skin diseases, chronic rheumatism, and se- [illegible] given in the form of *decoction*, made by [illegible] liquorice root, in Oiij water, down to [illegible] as a *masticatory* in cases of paralysis of the

[illegible] *Guaiaci Lignum et Guaiaci* [illegible] of the *Guaiacum officinale* (Fig. 23), an [illegible] America and the West Indies. The wood [illegible] a grayish bark, extremely hard and [illegible] or sap wood, is of a yellowish colour; the [illegible] green; commonly called *lignum vitæ*. It [illegible] when rubbed or burned; taste, bitterish and [illegible], activity depends on the contained guaiac.

[illegible] (*resin*) is procured either by spontaneous exudation, or by boiling the raspings and shavings in water, or by heating in the fire billets of the wood which have been bored longitudinally. It comes in masses of a deep olive-brown colour, mixed with various impurities; fracture resinous; odour feeble and balsamic; taste slight at first, but afterwards acrid; melts by heat, evolving a fragrant odour. Chemically, a mixture of a peculiar extractive, called *guaiacine*, and a resin; much more soluble in alcohol than in water.

Fig. 23.



*Effects.*—Stimulant, alterative, and diaphoretic; in large doses irritant to the bowels. Used in chronic rheumatism, secondary syphilis, and chronic skin diseases. Dose of guaiac, 10 to 30 grains. There are two tinctures, the *simple* and the *volatile* or *ammoniated;* the latter is used in dysmenorrhœa;—dose of either, f℥j.

**Sarsaparilla**, U. S.—Root of different species of the genus *Smilax*, as the *S. officinalis*, *S. sarsaparilla*, *S. syphilitica*, &c.; perennial, climbing plants, growing in Mexico and South America. The leaves are ovate, and alternately inserted upon short footstalks, with numerous tendrils proceeding from the stem. The roots are very long and slender, inserted upon a common caudex. Several varieties are known:—1. *Honduras sarsaparilla*,—comes in bundles two or three feet long, consisting of one or more roots, folded lengthwise, and secured by a few circular turns. 2. *Jamaica sarsaparilla*,—distinguished by the reddish colour of its epidermis, probably of similar origin with the last. 3. *Brazilian*, or *Para sarsaparilla*, sometimes called *Lisbon* and *Rio Negro* sarsaparilla,—this comes in cylindrical bundles, about three feet long and one thick; it is an excellent variety. There are also the *Caraccas* and *Mexican* varieties.

The dried root has but little odour; a mucilaginous and acrid ɜspecially when chewed for some time; imparts its virtues ɜr and alcohol; the cortical portion is the most active. It ıs a peculiar principle, called *sarsaparillin* or *smilacin*, also ʒtarch, lignin, &c. Long boiling is injurious to it.

*cts.*—An alterative diaphoretic; sometimes creates nausea ›miting. Improves the state of the constitution; slightly thens and induces plumpness in cachectic cases, and in de- states of the general health. Useful in secondary syphilis, ɔ rheumatism, chronic cutaneous diseases, &c. It is not often istered alone; generally in combination with the other stimu- diaphoretics. Dose of powder, ʒss to ʒj; of the *Infusion um Sarsaparillæ*, U. S.), made by macerating ℥j of the root ›int of boiling water, f℥iv. The *Compound Decoction* (*De- Sarsaparillæ Compositum*, U. S.), is made by boiling toge- ruised sarsaparilla with guaiacum wood, mezereon, liquorice nd sassafras, in water, for fifteen minutes, and then straining. made in imitation of the *Lisbon diet drink*. Dose, f℥iv l times a day. The *Compound Syrup* (*Syrupus Sarsapa- ’ompositus*, U. S.) is also officinal,—an excellent preparation; it ıs sarsaparilla, guaiacum wood, red roses, liquorice root, the sassafras, anise, and partridge-berry. Dose fʒss, three times

*Fluid Extract* (*Extractum Sarsaparillæ Fluidum*, U. S.) is by macerating bruised sarsaparilla, liquorice root, sassafras ınd mezereon, in dilute alcohol for fourteen days, then filter, gar, and evaporate down to the requisite bulk. It is a strong rtain preparation; dose, fʒi–ij.

root of *Aralia nudicaulis*, or *False Sarsaparilla*, an indi- plant, possesses kindred properties to those of sarsaparilla. :he same.

## CLASS XIV.

### EXPECTORANTS.

DICINES which increase or promote the evacuation of the ıial secretions. In the healthy condition there is a certain ıt of secretion always going on in the air passages, which is ɜd by evaporation or absorption; but in disease of these , there is either an arrest of the natural secretion, or it be- excessive, and *cough* results.

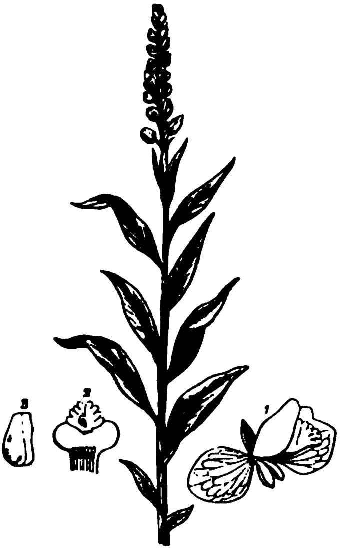
ıe expectorants are thought to act by producing relaxation, as the nauseating expectorants; others by stimulating the mucous exhalants; some, possibly, by sympathy from the stomach. The nauseating class are alone indicated in cases of inflammatory or febrile excitement; the stimulating, in cases of enfeebled action, or when of long duration. *Anodynes* are useful adjuvants, when the expectoration is attended with pain.

### NAUSEATING EXPECTORANTS.

The *emetics*, generally, prove expectorant, in consequence of the relaxation produced; only two, however, are much employed with this view, *tartar emetic* and *ipecacuanha;* the dose of the former is ¼ grain, or of *antimonial wine*, 15 to 25 drops every two hours; the dose of ipecacuanha is gr. ss–j, or of the wine, 25 to 30 drops.

### STIMULANT EXPECTORANTS.

Fig. 24.



**Seneka.** (*Senega*, U. S.)—Root of the *Polygala senega*, indigenous in the United States. A small, herbaceous perennial, with alternate smooth leaves. The root consists of a thick, knotty head, with the radicles much twisted, with a projecting, keel-like line. Colour, yellowish-brown externally, whitish within. The cortical portion contains the active principle, named *senegin* or *polygalic acid.* Odour, peculiar; taste, at first sweetish and mucilaginous, then acrid. Water and diluted alcohol extract its virtues.

*Effects.*—A stimulant expectorant, and diuretic; large doses act as an emeto-cathartic; sometimes also produce diaphoresis and emmenagogue effects. Used as an expectorant, where there is no inflammation; in latter stages of bronchitis, humoral asthma, secondary croup, &c. An ingredient in *Coxe's Hive Syrup.* Dose, 10 to 20 grains;—of the decoction (*Decoctum Senegæ*, U. S.; (℥j to Oiss water down to Oj) f℥j to f℥ij, three times a day;—of the syrup (*Syrupus Senegæ*, U. S.), fℨj.

ILL.—Already described as a *diuretic*. As an expectorant,
:h resembles senega, and is used in similar cases. May be
ageously combined with ipecacuanha, or tartar emetic. Dose,
everal times a day;—of the *vinegar*, f℥ss to f℥j;—of the
or *oxymel*, the same dose;—of the *tincture*, 20 to 40 drops.
*Hive Syrup* (*Syrupus Scillæ Compositus*, U. S.), contains
parts of squill and senega, together with tartar emetic;
ised in croup, catarrh, and hooping-cough; dose for a child, 10
o fʒj, according to the age.

CK SNAKE-ROOT. (*Cimicifuga*, U. S.)—Root of the *Cimi-*
*racemosa*, sometimes called *cohosh* and *richweed*, an indige-
erennial plant, several feet high, having ternate leaves, and
icemes of white flowers. The root consists of a tuberculated
:, several inches long, from which numerous slender, brittle
s proceed. Colour, blackish; odour, feeble; taste, bitter,
, and astringent. Virtues to boiling water; strongest when

*cts.*—Not especially an expectorant, but a general tonic and
int to the secretions, especially of the lungs, skin, and kid-
In very large doses, it seems to affect the brain. Used in
atism, hysteria, and pulmonary disorders; also an excellent
*r* in chorea. Dose of *decoction* (℥j to Oj water), a teacupful,
. times a day.

ILIC. (*Allium*, U. S.)—Bulb of the common garlic, *Allium*
*n.* It is about an inch in diameter, flattened, is covered by a
ane, and consists of several small conical bulbs, arranged
a common stem, called *cloves*. Odour, strong; taste, acrid
tter, depending on a volatile oil, which is of a yellow colour,
icly acrid and irritating. The expressed juice is the best for
il use; to be given mixed with sugar. Dose, f℥ss to f℥j.
*l* in chronic catarrhs, asthma, &c. Sometimes employed ex-
y, as a poultice to the feet of children.

AFŒTIDA.—As an expectorant, a good deal resembles *garlic*.
iable remedy in coughs of a nervous character, as hooping-
spasmodic asthma, infantile coughs, and coughs of old people.
5 to 15 grains, given in pill or emulsion.

IONIAC. (*Ammoniacum*, U. S.)—Inspissated juice of the
*a ammoniacum*, an umbelliferous plant of Persia. Found
*s* and in *masses*; the former is the purest; occurs in pieces
ous size, spheroidal; of a reddish-yellow colour externally;
when cold; of a resinous fracture. The masses are of a
colour, and contain many impurities. Odour, peculiar, in-
l by heating it; heat softens, but does not melt it; taste,
nauseous, and acrid; chemically, a gum-resin and volatile

oil, partially soluble in water and in alcohol; forming, with the former, a milky emulsion, and with the latter, a clear tincture.

*Effects.*—Similar to those of assafœtida, and the other fetid gum-resins. Used chiefly as a stimulant expectorant, in chronic enfeebled cases. Dose, 10 to 30 grains.

*Pilulæ Scillæ Compositæ*, U. S.—Contain squill, ammoniac, ginger, and soap;—dose, 5 to 10 grains, several times a day.

Externally applied, ammoniac causes irritation of the skin. Used sometimes as a *plaster* (*Emplastrum Ammoniaci*, U. S.)

**Galbanum**, U. S.—A substance much resembling ammoniac in its medical properties; not much used except for making plasters.

**Benzoin.** (*Benzoinum*, U. S.)—The product of *Styrax Benzoin*, a native of Siam and Malacca. The juice which exudes on incision, hardens on exposure. It is a balsam, used for obtaining *benzoic acid.*

**Balsam of Tolu.** (*Balsamum Tolutanum*, U. S.)—Product of the *Myrospermum Toluiferum*, or *Myroxylon Toluiferum*, growing in South America.—Procured by making incisions into the tree. When first procured, it is of a soft, tenacious consistence, but becomes hard and darker by exposure; odour, very fragrant; taste, pleasant and sweetish; inflames by heat; soluble in alcohol, ether, and the fixed oils; boiling water extracts its benzoic acid; chemically, it consists of benzoic acid, volatile oil, and cinnamic acid. The acid may be separated by sublimation;—it is used in making the *paregoric elixir.*

*Effects.*—A stimulant expectorant; used in chronic pulmonary complaints; a pleasant adjuvant to cough mixtures; dose, 10 to 30 grs. The *tincture* (*Tinc. Tolutana*), and *syrup* (*Syrupus Tolutanus*), are officinal; the latter used to flavour cough mixtures.

**Balsam of Peru.** (*Balsamum Peruvianum*, U. S.)—Product of the *Myroxylon Peruiferum*, or *Myrospermum Peruiferum*, growing in South America.—Believed to be procured by boiling the young branches; supposed by some, that both the balsams are the product of the same tree, one being obtained by exudation, the other by decoction. A thick, viscid fluid, resembling molasses; colour, dark reddish-brown; odour, fragrant, less pleasant than that of Tolu; taste, warm, bitter, and pungent; inflammable; yields its benzoic acid to boiling water; chemical composition, the same as that of Tolu.

*Effects.*—A warm stimulating expectorant and tonic, adapted to the same cases as the preceding; used sometimes externally to indolent ulcers. Dose, f℥ss.

## CLASS XV.

### EMMENAGOGUES.

**ICINES** which promote the menstrual discharge. It is nable whether there are any medicines which *specifically* he uterus; most of them seeming to act by contiguous sym- As amenorrhœa is sometimes a primary disease, and some- the result of other causes, the treatment must, in the first be directed to the restoration of the constitution to a natural in plethoric cases, depletion will be required; in the relaxed, course. Emmenagogues are usually most efficient when given fore the expected period of the discharge.

IN. (*Sabina*, U. S.)—Leaves of the *Juniperus sabina*, an en shrub, indigenous to Europe, and cultivated in the United It resembles in appearance the red cedar. As found in ps, the leaves are of a greenish colour, strong, heavy odour, tter and acrid taste; active properties depend on a yellow oil.

*cts.*—A stimulant to the secretions generally; over-doses are ritant, and even poisonous; by some highly esteemed as an agogue; its use very dangerous in pregnancy, in consequence irritation or inflammation of the uterus produced, bringing rtion. It is questionable whether it has the power of directly g uterine contraction. Dose, 5 to 20 grs.; of the oil, 2 to 5 three times a day;—acts as a rubefacient, when applied to in.

t of the drastic cathartics will prove emmenagogues, probably h the sympathy existing between the bowels and uterus. The ost employed, are *aloes* and *black hellebore*.

ES is one of the most efficient remedies in amenorrhœa, par- ly when combined with iron and assafœtida. It is contra-indi- n cases of inflammation or hemorrhoids. Dose, 1 or 2 grs., three times a day.

CK HELLEBORE—an uncertain emmenagogue, as found in the ; usually given in the form of tincture; dose, f℥ss to f℥j, three times a day.

IAC is by many highly recommended in amenorrhœa. Dr. s praises it also in dysmenorrhœa. Best given either in the f *tincture*, or *ammoniated tincture;* dose f℥j, three times

EKA is also esteemed emmenagogue by some writers; it is a general stimulant to the secretions, and may sometimes promote menstruation.

CANTHARIDES will often produce a decided emmenagogue effect; indicated only in cases of enfeebled action; never in cases of inflammation. Dose of tincture, 10 to 30 drops, three times a day. A blister to the sacrum will sometimes have the same effect.

The *Preparations of* IRON are perhaps the most certain of all the emmenagogues; they are more employed than the others; the *subcarbonate*, or the *sulphate*, usually preferred. They are particularly indicated in cases of chlorosis; never in plethora; often combined with aloes.

## CLASS XVI.

### SIALOGOGUES.

MEDICINES which promote the secretion of the saliva. Some articles effect this when taken internally, as antimony, silver, nitro-muriatic acid, iodine, and especially mercury; others produce it by a topical or local action, as mustard, ginger, tobacco, &c. As remedies, they are employed in paralytic affections of the tongue and throat; in diseases of the tonsils or salivary glands; sometimes as revulsives from neighbouring organs, as in toothache and earache. They are also called *masticatories*. They are all described under other heads.

## CLASS XVII.

### ERRHINES.

SUBSTANCES which promote the nasal secretion. As they generally excite sneezing, they are also termed *sternutatories*. They all act by direct application; and nearly any foreign substance applied to the mucous membrane of the nose will produce this effect. They are used as revulsives in amaurosis, chronic ophthalmia, &c.; also in syncope; also to promote the discharge of accumulated mucus, and of foreign bodies. The most powerful errhines, are Tobacco, Ammonia, Euphorbium, and Veratria.

# CLASS XVIII.

## EPISPASTICS.

ICINES which, when applied to the skin, produce a blister.
also *vesicatories*. The Rubefacients will also blister if applied
ifficient length of time.

*ts.*—They act as general stimulants to the system; and are
in typhoid cases; they will sometimes set aside a paroxysm
rmittent or remittent fever, by virtue of the powerful impres-
roduced. They are powerfully revulsive, and are used in
s of the internal organs. It is advisable not to employ them
very height of inflammatory diseases, lest the excitement
be increased. They produce local depletion by the serous
ge which they occasion. They also do good in certain cases,
stituting their own action, which spontaneously subsides, for
iorbid action in the part, as in obstinate herpes, &c. They
o employed for their local stimulant action; for the pain
they cause, in hypochondriasis; and to procure a denuded
for the endermic application of medicines.

NISH FLIES. (*Cantharis*, U. S.)—The *Cantharis vesicatoria*
insect from six to ten lines in length, by two or three in
h, of a shining green colour. They abound in the south of
e, and are collected in the summer by shaking them from
ees in which they lodge, and letting them fall into large
which are plunged into hot vinegar and water, for the pur-
destroying the insects: they are then perfectly dried in the
nd put into canisters. Odour, strong and peculiar; taste,
nd burning; colour of powder, grayish-brown, with fragments
ing green. Should not be kept in the powdered state, as it
apt to attract moisture and decompose. Apt to be attacked
ects; virtues to water and alcohol. Contain a peculiar crys-
principle called *cantharidin*.

*ts.*—Internally, a diuretic and emmenagogue; externally, it
the best epispastic. The following are its preparations:

*itum Cantharidis*, U. S.—(*Blistering Plaster.*)—Made by
together yellow wax, rosin, lard, and powdered flies. This
preparation used for spreading blisters. Soft leather, muslin,
er may be employed, and the cerate applied with a spatula,
t heat. The shape and size of the blister must be determined
part to which it is to be applied. Sometimes a thin gauze is
sed between the skin and cerate, which is thought to prevent
orption of the active principle. From six to eight hours is

sufficiently long to allow a blister to remain on: if vesication has not then taken place, a warm poultice is to be applied. For children, a much shorter time will suffice. The best *dressing* is simple cerate; or, if to be kept discharging, basilicon ointment; if not disposed to heal, a mixture of Goulard's and simple cerate. The strangury, often resulting from the application of blisters, is best relieved by an anodyne enema, and the free use of diluent drinks.

*Unguentum Cantharidis*, (U. S.)—Used only for dressing blisters, to maintain the discharge. Prepared by mixing the decoction with resin cerate, and evaporating to a proper consistence.

*Emplastrum Picis cum Cantharide*, (U. S.)—*Emplastrum calefaciens*, or *warming-plaster*. Prepared by melting together the cerate of cantharides with Burgundy pitch. Used as a gentle rubefacient in chronic cases. It sometimes causes vesication, particularly if improperly made.

*Linimentum Cantharidis*, (U. S.)—Made by digesting cantharides in oil of turpentine. A very powerful, prompt, and stimulating liniment, and vesicant. Used sometimes in typhus fever.

Other species of the Cantharis possess vesicant properties, particularly the *C. vittata*, or *potato-fly*, which is indigenous. It is smaller than the preceding, but resembles it in all its medicinal properties.

## CLASS XIX.

### RUBEFACIENTS.

MEDICINES which cause inflammation of the skin, when applied externally. The indications for their use, as well as the principles of their operation, are very much the same as those of Epispastics. The latter are preferred when a slow and stimulant effect is desired; the former, where the impression is to be sudden and transient. Rubefacients cannot deplete like blisters; they are likewise inferior in their power of breaking up morbid associations, as in intermittents. As revulsives, rubefacients are most useful in spasms and nervous affections; blisters, in local inflammations.

1. **BURGUNDY PITCH.** (*Pix Burgundica*, U. S.)—*Abies excelsa* or *Norway spruce fir*, a lofty evergreen, native of northern Europe. Procured by stripping off the bark, under which it concretes in large masses; then melting in boiling water, and straining. A spurious pitch is manufactured out of rosin and common pitch.—It

, brittle, and of a yellowish-brown colour, of a weak terebin-
odour and taste; usually contains many impurities.—Used
form of *plaster* to the skin, where it produces a mild rubefa-
fect. In some persons it brings out a pustular eruption.
*pitch plaster*, made by spreading the melted pitch on soft
, is used in chronic pulmonary and rheumatic complaints,

ADA PITCH. (*Pix Canadensis*, U. S.)—Product of the *Abies*
*ensis* or *Hemlock spruce*, a native of Canada and the Northern
The pitch, sometimes called *hemlock gum*, is a spontaneous
ion on the old trees; it is scraped off, boiled in water, and
d. It is hard and brittle, of a dark brownish colour, and
odour; heat softens and renders it adhesive.—Uses, and mode
lication, the same as the former.

JTION OF AMMONIA. (*Liquor Ammoniæ*, U. S.)—Prepared
urating water with gaseous ammonia; found in the shops of
it strengths. Applied to the skin, it produces a rubefacient,
ι epispastic effect very speedily; usually employed in combi-
with olive oil, in the form of *Linimentum Ammoniæ*, U. S.,
*tile liniment*,—made in the proportion of half an ounce of
monia to two ounces of oil; an excellent mild rubefacient in
itism, and catarrh, especially of children; may be farther
l if too powerful.
*wille's antidynous lotion* is made by mixing the strongest liquor
ia with oil of rosemary and tinct. camphor; it is a very power-
plication, and will cause vesication in a few minutes; used in
gia, &c.

STARD. (*Sinapis*, U. S.)—Product of two different species,
*Sinapis alba* and *Sinapis nigra* (Figs. 25, 26), natives of
e. Two kinds of seeds are found, the *white* and the *black*;
mer are of a light-yellowish colour, and globular; the latter
aller, of a dark-brown colour, externally, and whitish within.
iave no odour when whole; yield a yellow powder, which is
lly odorous when moistened; taste, hot, pungent, and bitter;
est in the black; the outer coating of both is mucilaginous;
ield a mild fixed oil, on pressure. The active principle of the
mustard is a volatile oil, which does not pre-exist in the seed,
developed by the reaction of water upon two organic princi-
amed *sinapisin* and *myrosyne*. In the white mustard, the
principle is a fixed acrid substance, which does not pre-exist
seed, but is generated by the reaction of water on *sulpho-*
*sin* and *myrosyne*.
llowed whole, the seeds are stomachic and laxative, and are
n dyspepsia. The powder, in small doses, is stimulant; in
quantities, emetic. Externally applied, it is an active rube-

facient, and is much used under the form of mustard poultice, as sinapism,—made by simply stirring up the powder with warm water; flour may be added to dilute it. It should not be allowed to remain on longer than from 15 to 30 minutes; never to produce vesication. Care should be taken not to leave it too long on persons insensible to pain, lest ulceration and sloughing result.

**Oil of Turpentine** is a powerful rubefacient; used by saturating a flannel and applying it to the skin; sometimes produces a violent inflammation and eruption on the skin.

**Cayenne Pepper** may be advantageously used as a rubefacient, by heating it in spirits, and rubbing it over the surface; particularly applicable in the low forms of disease.

Fig. 26.

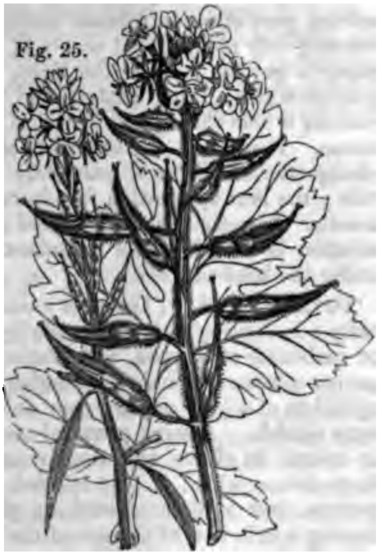


Fig. 25.

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## CLASS XX.

### ESCHAROTICS, OR CAUSTICS.

Substances which cause a slough by destroying the life of the part to which they are applied. Some of them act directly, others indirectly, through chemical agencies. Used to form issues or running sores, to repress fungous granulations, to change the character of diseased surfaces, and to open abscesses.

The *hot iron*, or *actual cautery*, is the most powerful escharotic; not so much employed at present as formerly; occasionally used to arrest hemorrhage.

The *moxa* is a modification of the actual cautery; it consists of small rolls of muslin soaked in a solution of chromate, or nitrate of

, and dried. When used, one end is set on fire, and the other
on the skin. It acts as a powerful revulsive;—useful in deep-
pains, paralysis, disease of spine, &c.

AR CAUSTIC. (*Argenti Nitras Fusus*, U. S.)—Made by dis-
pure silver in diluted nitric acid, evaporating, melting, and
g into moulds. It occurs in cylindrical pieces, enveloped in
o protect it from the light, which decomposes it. Colour,
-white; taste, austere and metallic; very soluble. As a
, it acts through its chemical affinities for the albumen of the
It is a safe and excellent escharotic; particularly useful to
the character of unhealthy ulcers, whether common or spe-
the best application for ulcers of the cornea; also to inflamed
. Sometimes a concentrated solution is preferred. The weak
n is an admirable stimulant application, as already noticed
the head of *Tonics*.

ASSA, U. S. (*Common caustic, Lapis infernalis.*)—Chemi-
*hydrate of potassa;* made by adding quicklime to a solution
onate of potassa, and evaporating the resulting solution to a
consistence, and then pouring into proper moulds. Occurs in
rs of a gray colour; very deliquescent; powerfully alkaline;
luble. A more powerful caustic than nitrate of silver; apt
nd its effects, and consequently not so safe; used chiefly to
ssues, which is best effected by rubbing a moistened stick of
over a piece of sticking plaster, applied to the skin, and
a hole in it of the size of the intended issue; sometimes used
open abscesses, and to destroy poisoned surfaces. The strong
sometimes applied to the spine, in tetanus.

*Potassa cum Calce*, U. S. (*Vienna paste*)—is used sometimes
bubos.

ED ALUM. (*Alumen Exsiccatum*, U. S.)—Commonly named
*lum;* prepared by heating alum until deprived of its water
tallization; a dull-whitish powder; a mild escharotic;—used
ess fungous granulations.

PHATE OF COPPER.—Usually applied in the solid form; in
state it forms the best remedy in *granulated conjunctivitis.*
ng solution is useful in *cancrum oris;* the weaker solution is
stimulant, as mentioned under the head of *Tonics.*

ENIC. (*Acidum Arseniosum*, U. S.)—Procured in smelting
s of arsenic; of a milk-white colour; vitreous fracture; trans-
within, but becomes opaque on exposure; has no odour;
aintly sweetish; powerfully poisonous; soluble in water and
. A dangerous escharotic from liability to absorption.—Used
in cancerous sores; also in lupus, and onychia maligna;
always be very much diluted before applying it.

**CORROSIVE SUBLIMATE.**—A powerful escharotic in the undiluted state, but seldom thus employed. A weak solution used as a gargle in venereal sore throat, and as a lotion in chronic skin diseases; recommended in onychia maligna, mixed with equal parts of sulph. zinc. More fully described under the head of *Mercury*.

The *solution of the nitrate*, and the *acid nitrate of mercury*, are also used as escharotics; the latter especially in ulcers of the uterus.

The *Mineral acids* are all powerfully caustic in the undiluted form; not used as such, however; but employed, sufficiently diluted, as stimulant washes to indolent ulcers.

## CLASS XXI.

### EMOLLIENTS.

MEDICINES which soften and relax the skin, when externally applied. They diminish the pain and tension of inflamed parts, often assisting in producing resolution; or, if too far advanced for that, they aid the suppurative process. Their action is believed to be purely mechanical. They all owe their efficacy to moisture; in fact, *water* is, by some, considered the only emollient; a temperature above 62° F. is requisite;—aqueous vapour is still more emollient than warm water. The usual method of applying emollients is by *cataplasm*, of which the best is that made from flaxseed meal. Nearly all the *Demulcents* have an emollient effect when externally applied.

## CLASS XXII.

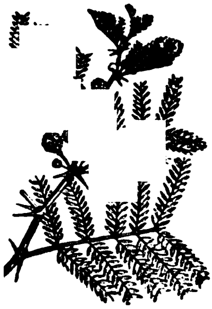
### DEMULCENTS.

SUBSTANCES of a bland, unirritating nature, capable of forming a viscid solution with water. They are closely allied to Emollients; in fact, they produce the same effect upon the internal passages as the latter do upon the skin. They consist chiefly of gum, sugar, oil, or starch, and are useful both as adjuvants to other acrid or irritating medicines, and also, when given alone, to defend inflamed or irritated surfaces, with which they come into direct contact, as the stomach and bowels,—when they may be given either by the mouth,

nema. Also very much used in inflammations and irritations
s on which their action must be indirect, as in bronchitis and
y disorders; in the latter instances, they probably act by
absorbed. Several of the demulcents are much used as arti-
diet for the sick. They are also used, in solution, as vehi-
r other medicines.

**ARABIC.** (*Acacia*, U. S.)—Product of several species of *Acacia*, especially the *A. vera*, *A. Senegal*, and *A. Arabica*. They are thorny shrubs, or trees, growing in the deserts of Arabia, Africa, and India. The gum exudes spontaneously and by incisions. The varieties are as follows:—1. *Turkey gum*, imported from the Levant; comes in small, irregular fragments, either whitish, or very light yellowish-red: among these are larger round pieces with numerous cracks, brittle, and completely soluble in water. 2. *Gum Senegal*, from the western coast of Africa; larger fragments, darker colour, less brittle, of a conchoidal
re. 3. *Gum Barbary*, from the northern part of Africa; has
c colour, apt to contain impurities, less abundant than the
.—Guerin has discovered three distinct principles in gum:—
*abin*—found in pure gum Arabic, and which is completely
e in water. 2. *Bassorin*—found in Bassora gum; characte-
by swelling up considerably in water, but not dissolving. 3.
*in*—found in the gum of fruit trees; distinguished by being
ted into arabin by the action of boiling water.

Fig. 27.



s.—Chiefly as a demulcent, in pectoral affections, diarrhœa,
sentery; an ingredient in most cough mixtures; also in phar-
in the compounding of pills. *Mucilage* for drink is made by
ing ℥j in Oj of water.

*syrup* (*Syrupus Acaciæ*, U. S.), is chiefly used in pharmacy.

**GACANTH.** (*Tragacantha*, U. S.)—Product of several species
*agalus*, particularly of *A. verus*,—small, thorny shrubs grow-
Persia and Asia Minor. The gum exudes spontaneously.
s in irregular, tortuous pieces, of a dirty yellowish colour;
cent, resembling horn; hard, but difficult to pulverize; con-
hiefly of *bassorin*; swells up, but does not dissolve in water,
s with it a paste. A demulcent,—used chiefly in the prepa-
of troches.

**ELM BARK.** (*Ulmus*, U. S.)—Inner bark of the *Ulmus*
indigenous tree. It is stripped off in pieces several

feet in length, and folded longitudinally. Colour, tawny; texture, fibrous; odour, peculiar; taste, sweetish, peculiar, and mucilaginous. It is a good demulcent, and is used in dysentery, &c.; also nutritious; generally given in infusion. (*Infusum Ulmi*, U. S.) The powder may be employed by simply stirring in boiling water, and made of any thickness, and flavoured according to the taste. A poultice made from the powder forms an excellent emollient application to the inflamed skin.

**Flaxseed.** (*Linum*, U. S.)—Seeds of the *Linum usitatissimum*, or common flax. They are about a line in length, oval, of a brown colour, and glossy. The cuticle abounds in mucilage; the interior contains a fixed oil, which is procured by expression, and called *Linseed oil*—much used in the arts. The mucilage is obtained by infusing the seeds in boiling water; not proper to boil them, since the oil would then be extracted, which is unpleasant to the taste;—proportions, ℥j to Oj of water, flavoured with lemon-juice and sugar;—much used in pectoral and bowel affections, and nephritic disorders. The ground seed forms with hot water an excellent emollient poultice.

**Irish Moss.** (*Chondrus*, U. S.)—Usually called *Carrageen*;—botanically, *Chondrus crispus*. It grows on the rocks on the northern coasts of Europe,—particularly Ireland; also in this continent. Consists of a flat, cartilaginous frond, several inches long, curled, and of a yellowish colour;—odour, feeble; taste, slight; insoluble in cold water, but soluble in boiling water;—contains starch, pectin, and other matters. A nutritive demulcent, used in pectoral complaints, dysentery, nephritic disorders, &c. Decoction, made by boiling ℥ss in Ojss to Oj. Made also in the form of a jelly, properly flavoured, as an article of diet.

**Iceland Moss.** (*Cetraria*, U. S.)—Botanically, *Cetraria Islandica* (*Lichen Islandicus*); grows in the northern parts of both continents,—inland. It is from 2 to 4 inches long; dry, coriaceous, and smooth; deeply channeled; of a grayish-white and brown colour; no odour; of a bitter, mucilaginous taste; soluble in boiling water. It contains a bitter principle, *Cetrarin*, which renders it slightly tonic as well as demulcent;—the bitterness may be removed by weak alkaline solutions. Used in chronic pectoral affections, attended with debility; also in chronic diarrhœa and dysentery. Decoction made by boiling ℥j in Ojss of water down to Oj.

**Liquorice Root.** (*Glycyrrhiza*, U. S.)—Root of the *G. glabra*, growing in the south of Europe, having a round, tough, and pliable root. As found in the shops, it is in long pieces, varying from a few lines to an inch in thickness; of a yellowish-gray colour externally; yellow within; taste, sweet and somewhat acrid. It contains a peculiar saccharine principle called *glycyrrhizin*, which differs

gar in not undergoing the vinous fermentation; it also con-
me starch, and a resinous acrid matter. A good demulcent,
chiefly as an adjuvant with other acrid medicines. Decoc-
ade with ℥j to Oj water. The powdered root used for sprink-
er pills.

*orice* (*Extractum Glycyrrhizæ*, U. S.),—made by evapora-
e decoction. The best is imported from Calabria. Comes
k, flattened cylinders, about an inch in diameter, shiny when
; of a sweet taste;—much used in cough-mixtures and
s.

LEY. (*Hordeum*, U. S.)—Prepared for medicinal use by clean-
grain, and rounding and polishing in a mill; it then consti-
*earl barley.* It is in small, white, oval grains, with a dark,
dinal furrow on one side. Consists of starch, gum, sugar,
ten;—apt to become musty by long keeping. Virtues yielded
ng water.

*ey Water.* (*Decoctum Hordei*, U. S.)—Made by washing ℥ij
in cold water; then boil for ten minutes in a small quantity
r; throw away this water, and add Oij boiling water, and
wn to Oj;—an excellent drink in inflammatory and febrile
ns;—may be flavoured with lemon-juice and sugar.

OW ROOT. (*Maranta*, U. S.)—Product of the *Maranta arun-*
, growing in the West Indies and Central America; also in
. The root is perennial and tuberous, and is prepared for
first washing, then beating into a pulp, and thrown into
and stirred, so as to separate the fecula; it is then strained
h a sieve and allowed to dry. The best is imported from
da. It is a white, light powder; no odour nor taste; chemi-
pure starch; often adulterated with potato starch; can only
inguished by the microscope. A nutritious demulcent, par-
y adapted to children as an article of diet, also in bowel-af-
. Given, by first forming a paste with cold water, and then
this to boiling milk or water.

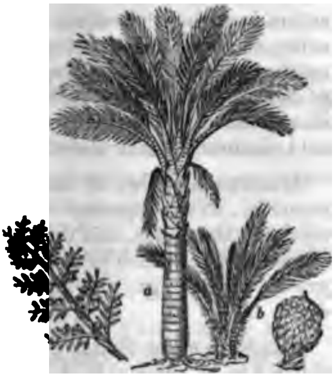
*Canna root,* or *Tous-les-mois,* is very similar to the arrow
comes also from the West Indies.

OCA, U. S.—Fecula prepared from the root of the *Jatropha*
*t,* or *cassava plant,*—a native of the West Indies and tropical
a. The root is large, fleshy, and tuberous. There are two
s, the sweet and the bitter. The latter contains an acrid,
us principle; still, it is the one most cultivated for tapioca,
s poisonous principle, being volatile, is dissipated by heat.
ice being expressed from the root, deposits its starch on
g, and is then dried by exposing it to heat. It is in irregular,
hite, rough grains, with little or no odour and taste. Pre-
or use by boiling in water, which converts it into a sort of

jelly. Used exclusively as an article of diet; may be flavoured to suit the taste;—brandy or wine may be added, in cases of debility, or irritability of stomach.

**Sago**, U. S.—Product of the *Sagus Rumphii*, or *sago palm*, indigenous in the East Indies, growing about 30 feet high. The sago resides in the pith of the trunk; this is agitated in water, to which it imparts its starch; this subsides, and is passed through a sieve, when the farina is deposited on standing, and then dried; this is *common sago*. It is in grains of unequal size, of a yellowish colour. The finest kind, called *pearl sago*, is refined by the Chinese; it is in small, round grains, whitish, hard, and sometimes translucent, with no odour, and a slight taste. It consists almost entirely of pure starch; insoluble in cold water; requires long boiling.—Uses and modes of preparation, the same as the tapioca.

Fig. 28.



## CLASS XXIII.

### DILUENTS.

Mild liquids, which dilute the contents of the stomach and bowels; and which, entering the blood-vessels, render the blood thinner, and, at the same time, dilute the secretions. Water is the only liquid, strictly speaking, which can be used for these purposes; water is, in fact, the great diluent of nature. The additions which are usually made, are for the purpose of imparting flavour, or rendering it more nutritive. Diluents are useful in inflammatory diseases,—in cases of acrid poisons,—as adjuvants to emetics, &c., to restore a proper degree of fluidity to the blood. The demulcents form the best diluent drinks.

## CLASS XXIV.

### ANTACIDS.

ICINES which combine with, and neutralize acids. Their is entirely chemical. Although all salifiable bases are ant- the only ones employed remedially are the alkalies, alkaline and alkaline carbonates. They do good by removing excess l in the stomach and bowels, which is frequently the cause of , as colic, diarrhœa, &c. They are also useful in the uric athesis, where there is a tendency to gout, and gravel.

NESIA.—One of the most valuable of the antacids;—very ul, in consequence of its low combining number; used exten- in the colics, and diarrhœas of children, either alone, or com- with rhubarb or calomel; also in sick headaches, gout, and Dose, gr. x to ʒj.—The *carbonate* is given in double the

BONATE OF SODA. (*Sodæ Carbonas*, U. S.)—Procured from hes of sea-weeds, in the impure forms of *kelp* and *barilla;* lly manufactured from the sulphate, by decomposing it with ate of lime. It is in large, rhomboidal crystals, efflorescent, luble in water; taste, alkaline; unequal in strength. Dose, 30 grs.;—of the dried salt, 5 to 10 grs.

ARBONATE OF SODA. (*Sodæ Bicarbonas*, U. S.)—*Supercarbo- f Soda.*—Prepared by passing carbonic acid gas through a n of the carbonate, and crystallizing at a low heat. Usually as a white powder, and contains some sesquicarbonate;—not ble as the carbonate, but less disagreeable to the taste. Given pepsia, &c.; also used in making soda and Seidlitz powders. e, gr. 10 to ʒj.

BONATES OF POTASSA.—Already spoken of under *Diuretics*. acids, the *carbonate* is given in the dose of 10 to 20 grains; arbonate, in from 20 to 40 grains.—The *infusion of hickory* is sometimes used as an antacid: it owes its efficacy to the ate of potassa which it contains.

ior *Potassæ*, U. S.—Solution of Potassa is an excellent ant- the diarrhœas of children; also in dyspepsia, used with

E. (*Calx*, U. S.)—Used medicinally only in solution, under me of *lime-water* (*Liquor Calcis*, U. S.);—made by dissolving lime in water, and keeping it in well-stopped bottles, with a portion of lime undissolved, in order that it may be always saturated. It is colourless, of an alkaline taste and reaction; combines with the carbonic acid of the air, and forms a pellicle of the carbonate. Used generally in combination with fresh milk, as a remedy for irritable stomach,—a tablespoonful of each, taken every half hour. Externally, in combination with linseed oil, as a liniment for burns.

The *carbonate* is used internally in the form of *prepared chalk*, and *prepared oyster-shells*. Prepared chalk (*Creta Præparata*, U. S.), occurs in the form of small, white, conical masses, insoluble in pure water, somewhat soluble in carbonic-acid-water. It is astringent as well as antacid, and is very useful in diarrhœas accompanied by acidity—particularly in children; dose, 5 to 20 grains, every hour or two. The *Chalk mixture* (*Misturæ Cretæ*), is made by rubbing up chalk with sugar and gum, and adding cinnamon-water. —Chalk is sometimes applied externally as an absorbent.

*Prepared oyster-shells* (*Testa Præparata*, U. S.), are made from the common shells by grinding, &c., as for prepared chalk. They differ from it only in containing a little animal matter.

*Uses.*—The same.

The *precipitated carbonate* (*Calcis Carbonas Præcipitatus*, U. S.), is made by the reaction of carbonate of soda on a solution of chloride of calcium. It is a fine, white powder.

**Ammonia.**—A stimulant antacid, given in aqueous or alcoholic solution. The *Liquor Ammoniæ* and the *Spiritus Ammoniæ* are seldom used internally, in the undiluted form. The *Spiritus Ammoniæ Aromaticus* is an excellent stimulant in languors, faintings, flatulent colic, &c. *Carbonate of ammonia* is also antacid.

## CLASS XXV.

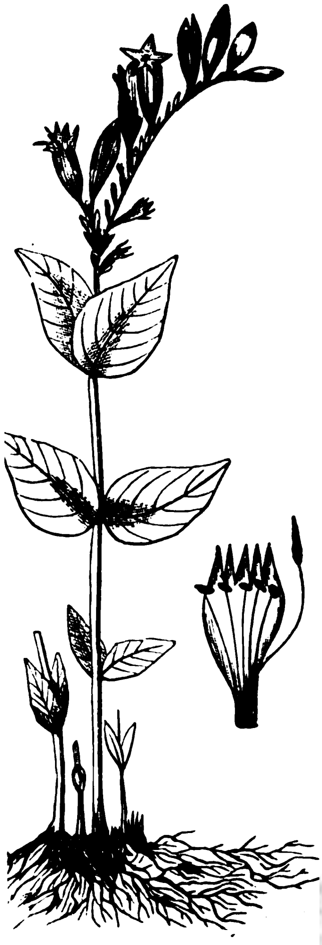
### ANTHELMINTICS.

Medicines which destroy, or expel worms from the alimentary canal. Some act by a direct poisonous influence upon the worms, causing their death; others, by a purely mechanical method; others, again—as the drastic cathartics—through the increased amount of mucous exhalation produced.

**Pink Root.** (*Spigelia*, U. S.)—Product of *Spigelia Marilandica*, an indigenous, herbaceous perennial, growing in the Southern

. The root is the officinal part. It consists of numerous ıing, wrinkled fibres, attached to a caudex; colour, brownish-externally; odour, faint; taste, sweetish and bitter. It contains a fixed oil, and a peculiar bitter extractive, which is the active principle, and some others. Large doses are cathartic and sometimes narcotic. It ranks high as an anthelmintic, destroying the worms. Given in powder and decoction; dose of powder for a child two to four years old, 10 to 20 grains; often combined with calomel. The infusion (*Infus. Spigeliæ*, U. S.) made with ℥ss to Oj. Often combined with senna, to insure its purgative effect. The *Extractum Spigeliæ et Sennæ Fluidum*, U. S., is an excellent preparation; dose, fʒj–ij.

Fig. 29.



WORMSEED. (*Chenopodium*, U. S.)—Seed of the *C. anthelminticum*, or Jerusalem oak, and also of *C. ambrosioides*, indigenous perennial plants, growing throughout the United States. The seeds are about the size of a pin's head; of a greenish-yellow colour, pungent taste, and a peculiar aromatic odour; virtues depend on a volatile oil. They are an excellent anthelmintic; peculiarly adapted to expel the lumbrici of children; best given as an electuary with molasses; to be administered for several successive days, en followed by a cathartic; dose, ℈j–ij. The oil is of a ellow colour, grows darker by time; given in the dose of 5 ırops.

**POMEGRANATE BARK.** (*Granati Radicis Cortex*, U. S.)—The bark of the pomegranate root is powerfully anthelmintic; useful in the expulsion of the *tape-worm;* best given in decoction made by boiling ℥ij in Oij water, down to Oj; dose, one third, to be taken every half hour.

**PRIDE OF CHINA.** (*Azederach*, U. S.)—Bark of the root of the *Melia Azederach*, a beautiful tree, growing in the Southern States. The bark is most powerful in the fresh state; taste, bitter and nauseous. In full doses, it is emeto-cathartic; overdoses are narcotic. Best given in decoction, repeated for several days, and then followed by a cathartic.

**MALE FERN.** (*Filix Mas*, U. S.)—Root of the *Aspidium Filix Mas*, growing in Europe and North America. The root is long, cylindrical, and flexible, covered over with the remains of the leafstalks. As found in the shops, it is very apt to be deteriorated. Colour, externally, brown; odour, feeble, but peculiar; taste, astringent and nauseous. It is slightly tonic, and very astringent; also anthelmintic; used to expel the tape-worm. Not much used at present. Dose of powder, ʒj to ʒiij; of the oil, 30 to 40 drops; of the ethereal extract, gr. x–xx.

**COWHAGE.** (*Mucuna*, U. S.)—Legumes or pods of the *M. pruriens*, a climbing West India plant. The pod is about four inches long, shaped like an Italic *f*, covered over with brown, bristly hairs, which easily separate when handled, and produce intense itching. Used by steeping the pods in molasses or honey, and then scraping off with a knife. It acts as an anthelmintic in a mechanical manner,—the spiculæ, adhering to the worms, causing them to loose their hold on the intestine. Dose, of the electuary, a teaspoonful to a tablespoonful, to be given for several successive mornings, and then followed by a cathartic.

**OIL OF TURPENTINE.**—Powerfully anthelmintic in large doses; particularly useful in expelling tænia; its purgative operation must be always insured by combining it with, or following it by castor oil. Dose, f℥j to f℥ij. In smaller doses, it is very efficacious in removing the ascarides of children, to whom it may be given in combination with castor oil, or else by enema.

**TIN.** (*Stannum*, U. S.)—Used in the form of powder, which is prepared by melting tin, stirring while cooling, and then passing through a sieve; believed to act mechanically; used chiefly to expel lumbrici, and tænia. Dose, ʒj to ʒij, repeated, and then followed by a brisk cathartic.

**OMEL.**—An excellent anthelmintic for children; best adminis-
by giving a grain or two every night, or every other night,
llowing, in the morning, with a dose of castor oil and oil of
tine. It, no doubt, acts through the agency of the bile which
ed out.

THE END.

[illegible]

CHEMISTRY.

# A
# HAND-BOOK
# OF
# CHEMISTRY.

A

# HAND-BOOK

OF

# CHEMISTRY:

With Nineteen Illustrations.

BEING A PORTION OF

AN ANALYTICAL COMPENDIUM

OF THE

VARIOUS BRANCHES OF MEDICINE.

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# CHEMISTRY.

## PRELIMINARY OBSERVATIONS.

Physical Science, in its most extended sense, comprises the two great divisions of *Natural History* and *Natural Philosophy*. The former includes Anatomy, Zoology, Botany, and Mineralogy; the latter embraces Chemistry, Geology, Physiology, and Mechanics.

Chemistry may be defined to be the science which investigates the molecular changes of bodies; or more strictly, that which treats of the laws that relate to chemical attraction.

The whole material world is subject to *Force;* this it is which produces change in bodies. Two great opposing forces appear to exist,—Attraction and Repulsion: the *cause* of either is unknown, and purely speculative. Bodies are either solid, liquid, or gaseous, according as one or other of these two forces preponderate; thus, if the molecules of a body adhere with a force called *cohesion*, so that an exterior power is required to separate them, the body is termed a *solid;* if the cohesion is only such as to allow the particles to move upon each other, it is named a *liquid;* and if the particles are kept apart by a repulsive force (supposed to be Caloric), it is denominated a *gaseous* body.

Attraction comprises several species or subdivisions, as Cohesion, Chemical Attraction or Affinity, Gravitation, Capillarity, and Endosmose.

*Cohesion.*—This is the attraction between homogeneous particles. It is only exerted at insensible distances, the molecules never being in absolute contact, otherwise the property of *elasticity* could not exist, since this requires space for the molecules to move in.

*Chemical Attraction or Affinity.*—This is the attraction between heterogeneous particles. Like cohesion, it is exerted only at inappreciable distances; in other words, apparent contact must take place.

*Gravitation.*—This attractive force is displayed between masses, and at sensible distances. It gives weight to bodies, and it is the f the tendency of bodies to fall towards the earth's centre. eat law of gravitation is, that "the attraction is directly as ntity of matter, and inversely as the square of the distance." w also regulates the movements of the solar system.

*illarity.*—This is the attraction exerted between liquids and es, called *capillary*, by which the liquid rises in the tube he level of the surrounding liquid,—the height depending smallness of the diameter of the tube, being inversely to the This is the cause of bodies being wetted when placed in with certain liquids, the latter being attracted to the surf the former. Capillarity is not exerted equally between all nd liquids; on the contrary, in some cases there is a posipulsion, as between glass and mercury. The mere density liquid does not, however, modify the force.

*osmose.*—If a membrane be interposed between two liquids of it density, having an affinity for each other, they will intery passing through the pores of the membrane. But the y with which the two currents are established, will be unand will be modified by the membrane. The general law is, *stronger current is from the rarer to the denser liquid.* The ndosmose is at present used to express this stronger current, ter which direction it may take.

s evidently a modification of Capillarity, though it is influby the relation subsisting between the membrane and the of the liquid. The essential conditions of endosmose are le liquids should have an affinity for each other, and that them, at least, should have an affinity for the membrane.

ther physical force, frequently considered as a modification of nose, is the *Diffusibility of Gases*, or the tendency of gases mingle, even though differing in density, and separated by a partition. This is readily shown by taking a wide glass nd placing in its centre a septum of dry plaster of Paris, and ling one side of it with oxygen, and the other with hydrogen. o gases will penetrate the septum, though at very different four cubic inches of hydrogen will pass into the oxygen side, nly one cubic inch of oxygen will pass in the other direc-According to Mr. Graham, the diffusibility of gases *is inas the square root of their densities;* thus, in the instance given, the densities of hydrogen and oxygen are to each s one is to sixteen, hence the diffusive power of the former is nes greater than that of the latter. This law is of great ance in nature, preventing the accumulation of noxious gases one spot, and regulating the intimate mixture of the constiof the atmosphere.

le process of respiration, the interchange between the oxygen air and the carbonic acid of the lungs is effected through *moist* membranes, which considerably modifies their respective diffusibility, on account of their different solubility in water.

Under the present head we may most conveniently notice the subject of the physical constitution of the atmosphere and of other gases, and the method of ascertaining specific gravity.

**Physical Condition of the Atmosphere.**—The proof that the atmosphere has weight is afforded in various ways, although we are not ordinarily sensible of it, as it surrounds us on every side, and is thus maintained in equilibrium. By weighing a large glass receiver before and after its contained air has been exhausted, we shall perceive an obvious difference in the weight. By placing the hand over the mouth of a small receiver, and exhausting the air from the interior, a painful pressure will be experienced from the superincumbent atmosphere. If a bladder be tied over an open-mouthed receiver, and the air be exhausted, the pressure will be sufficient to burst the bladder with a loud report. A similar result follows if a very thin glass receiver be exposed to the exhausting operation of the air-pump. All the above experiments prove that the atmosphere has weight; the *amount* of this weight is easily shown by the Torricellian experiment, which consists in filling a glass tube, closed at one end, forty or fifty inches long, with mercury, and plunging the open end in a vessel of the same liquid; the mercury will descend to about the level of thirty inches. It is kept at this height by the atmospheric pressure on the mercury in the basin. Now it is ascertained that a column of mercury thirty inches high and one inch square weighs about fifteen pounds; hence the inference that the atmosphere presses upon every square inch of the earth's surface with a weight equal to fifteen pounds. If water had been used in the above experiment, it would have risen to the height of thirty-four feet.

The *barometer* is but a modification of Torricelli's tube. It consists of a glass tube, a little over thirty inches long, closed at one extremity; it is filled with mercury, and then inverted so as to place the open end in a small cup of mercury; the pressure of the atmosphere upon the surface of the latter sustains the mercury in the column, as before mentioned. The use of the barometer as a *weather-glass* depends upon the fact that the atmospheric pressure varies at the same place; when it is greatest, the barometer will of course stand highest, and will indicate fair weather, and *vice versâ*.

As already remarked, gases are far more elastic than either solids or liquids. The elasticity of the air, and of gases generally, depends upon the degree of pressure to which they are subjected. By the law of Mariotte, *their density and elastic force are directly as the pressure, and inversely as the volume*. Thus, one hundred

nches of air under any pressure, would expand to two hun-
ıbic inches if the pressure were reduced one-half, or contract
cubic inches if the pressure were doubled.

he height of the barometric column measures the pressure of
nosphere, it follows that the higher we ascend, the lower will
umn fall, on account of the diminished height, and conse-
y the weight, of the atmospheric column. Hence the baro-
is a valuable instrument for measuring the height of moun-
It has been ascertained that a fall of one inch indicates an
e of about 922 feet; this ratio is true only near the level of
a, for as the height increases arithmetically, the pressure
shes geometrically. At three miles elevation, the barometer
at fifteen inches; at six miles it reaches 7·50 inches; at nine
3·75 inches, &c. The whole height of the atmosphere is
d to be about 45 miles.

action of the common water-pump and of the air-pump
ls solely on atmospheric pressure; the elevation of the piston,
er case, producing a vacuum which is instantly filled by the
re of the air forcing in the fluid.

CIFIC GRAVITY.—By this is meant the ratio of the weight of
to its bulk, or the weight of a body compared with the
of an equal bulk of some standard, which is received as
In solids and liquids this standard is pure water at the
ature of 60° F.

*find the specific gravity of a liquid*, it is only requisite to
equal bulks of that liquid and water at the same temperature,
en divide the weight of the liquid by the weight of the water;
otient will of course be greater or less than unity, as the
employed is heavier or lighter than water. Now, the sim-
ode of weighing equal bulks is to weigh them in succession
same vessel, taking care to have exactly the same quantity
cases. Another method is to employ a solid body, as the
of a bottle, ascertain how much weight will sink it in the
iquid, and divide this by the weight required to sink it in
this is obviously the same as ascertaining the weights of
tive bulks of the two, since a solid body always displaces its
*lk* of a liquid.

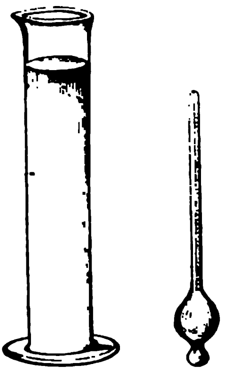
*nd the specific gravity of a solid.*—Another method of finding
cific gravity of a solid body lighter than water, is first to weigh
e air, then to attach to it a piece of metal heavy enough to
and weigh the whole as before, and afterwards weigh the
n water. The difference between the two last weighings gives
ght of the bulk of water equal to the whole mass. But we
find the weight of the bulk of water *equal to the light body*:
done by subtracting from the last-mentioned weight the
of a bulk of water equal to the piece of metal. Finally, we

divide the absolute weight of the light body in air by the weight of its equivalent bulk of water, as in ordinary cases, and the result will of course be less than unity.

The principle here is precisely the same as in the case of liquids: the rule being "to divide the weight of a given bulk of the body, by the weight of an equal bulk of water;" and the mode adopted is first to weigh the body in the air, then to weigh it in water; find out how much it loses by being weighed in water (which will express precisely the weight of an equal bulk of water), and then divide the first weight by this last, and the quotient will be the specific gravity. This rule is founded on the hydrostatic law, that when a solid is immersed in a fluid, it loses a portion of its weight exactly equal to the weight of the portion of fluid displaced; that is, equivalent to the weight of its own bulk of that fluid. If the solid be lighter than water, as in the case of cork, its specific gravity may be found by suspending a small glass funnel from a scale beam, and counterpoised so as to be just below the surface of the water; the lighter body is then to be thrown up under the funnel, which will, of course, destroy the equilibrium, and elevate the funnel. Ascertain how much weight will counteract the buoyancy of the light body, add this to its weight, and divide its weight by the sum; the quotient must, of course, be less than unity.

*Hydrometers* are instruments employed for ascertaining the specific gravity of liquids. They consist of hollow metallic balls, attached to a thin stem, and having a weight beneath, to keep it erect. The use of the hydrometer is very simple. The liquid to be tried is put into a narrow vessel, and the instrument floated in it. It is obvious that the denser the liquid, the higher will the hydrometer float; and *vice versâ;* the point on the graduated stem will then express the specific gravity.

Fig. 1.



*To ascertain the specific gravity of gases*, it is only requisite to fill a globe of known capacity with the gas, then to weigh it, and to divide the result by the weight of the same bulk of atmospheric air, which is the standard, or unity, for gases. It must also be remembered that the specific gravity of gases is influenced by their *purity*, their *hygrometric condition*, the degree of *pressure* to which they are subjected (their bulk being inversely as the pressure), and their *temperature.*

# PART I.

## IMPONDERABLE SUBSTANCES.

## SECTION I.

### CALORIC.

term *Heat* is used in two different senses: one signifying the
on conveyed by a heated body; the other, the material *cause*
t; this latter is called *caloric*. The effect of the union of
with ponderable matter is to communicate a repulsive pro-
to its different molecules, overcoming its cohesion; and
, successively, expansion, fusion, and vaporization. Caloric
lly spoken of under the two heads of *sensible*, or that which
ent to the thermometer, and *latent*, or that which is insensible
thermometer. *Latent heat* may be illustrated by the fol-
experiment:—Mix a pound of water at 174°, and a pound
er at 32° together; the temperature of the mixture will be
an of the two, or 103°; but if a pound of snow or ice at
used instead of the water at 32°, the resulting temperature
ill be only 32°, but the ice will have melted. Hence, in this
xperiment, as much heat has been rendered latent in the
g of the ice, as would have raised an equal weight of water
*ndred and forty-two degrees*. Again, if a vessel containing
be placed over the fire, the thermometer will indicate the
nt increase in its temperature up to the boiling point, 212°;
this point, however, provided the steam escape, the succes-
rtions of heat received by the liquid will be entirely insen-
that is, the additional caloric will be rendered latent. This
caloric may, however, be proved to exist, or may be rendered
, by conducting the steam into cold water, when it will be
to raise the temperature of a quantity of water ten times
than itself, nearly one hundred degrees; or, if concentrated
of these parts, the rise of temperature would be nearly one
nd degrees. Hence it follows, that as much heat is absorbed
ed latent) in producing steam, as would raise the water of
it is composed one thousand degrees, or to about a red heat, if
ed from assuming the aeriform state.

above law is universal. Whenever a solid body becomes liquid, or whenever a liquid becomes gaseous, a quantity of heat disappears, or is rendered latent; and conversely, when a gaseous body is converted into a liquid, or a liquid into a solid, a corresponding degree of caloric is given out, or rendered free. The amount of latent heat varies much in different substances.

On this principle, the cold produced by the various *frigorific* mixtures is explained; thus a mixture of snow and salt produces a cold of zero, in consequence of the attraction between the salt and water producing liquefaction, and thereby rendering latent a large amount of caloric. A notable depression of temperature is also caused by a simple solution of certain salts in water, as of nitre, sal ammoniac, &c. A striking example of the reverse process, or the rendering latent heat sensible by condensation, is afforded in the slaking of lime by water; here, the large amount of heat evolved arises from the water passing into a solid state, in its combination with the lime. Another familiar instance is the rise of temperature usually experienced before a snow-storm, in consequence of the condensation of the vapour into snow, thus giving out its latent heat. Latent heat has hence been denominated the *heat of fluidity*, since it is necessary to maintain bodies in the fluid condition.

### EFFECTS OF CALORIC.—EXPANSION.

*Expansion* is one of the first effects of caloric. It is caused by the repelling power produced by the caloric upon the particles of the body. As it is opposed to cohesion, it follows that those bodies are most expanded by heat which are least influenced by cohesion; thus gases are more expansible than liquids; and liquids more than solids.

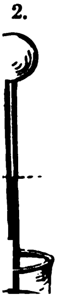
*Expansion in Solids.*—This may be proved, by accurate measurement of them before and after heating;—by an accurately-fitted metallic plug and ring; if the plug be heated it will be too large for the ring;—the same is shown in heating the tire of a wheel before hooping it;—it is seen also in the elongation of the metallic bar of the *pyrometer*, by heat.

Of solid bodies, the *metals* are the most expansible. Metals are not equally expansible;—lead is most so; platinum the least. If a thin, straight bar of iron be firmly riveted to one of brass, and then exposed to heat, the brass being more dilatable than the iron, forces the bar in a curve, the convex side of which is brass; if it be artificially cooled, the brass contracts more than the iron, and the reverse of the above effect is produced. The supposed exception to the general law that solids expand by heat, in the case of clay, is only an apparent one; the contraction of this substance, as seen in Wedgwood's pyrometer, by the action of heat, is due to the shrinking produced by the loss of water. Beyond certain limits solids do not expand uniformly for equal increments of heat.

*ansion in Liquids.*—Liquids differ from *fluids* in not being ;—they are more expansible than solids, as shown by placing holic and a mercurial thermometer in the same heated sub- ; the alcohol will rise much higher in the tube than the mer- Liquids are not equally expansible. Nor is there any n between their expansibility and their other properties, as y, &c. In being heated from 32° to 212°, alcohol expands its bulk; water $\frac{1}{23}$d; mercury $\frac{1}{55}$th. The *rate* of expansion uids is not uniform,—it increases with equal increments of There is one remarkable exception in the law that liquids l by heat, in the case of water near the freezing point, which *ls* on being cooled below 39°—hence ice swims on water; pansion is due to a new arrangement of its particles in the freezing.

*ansion of Gases.*—Gases are much more expansible than either liquids or solids;—their *rate* of expansion is uniform, and is very nearly the same for all gases, being about 480th of the whole volume for every degree of Fahrenheit.

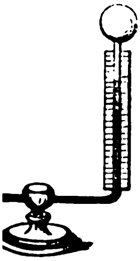
2.



*Thermometers* are instruments for measuring sensible heat by means of the expansion and contractions of some fluid. *Sanctorio's* thermometer was the first invented;—it consisted of a glass tube terminating in a bulb, partially filled with air, and the open end plunged into some coloured liquid; the expansion or contraction of the contained air was marked by the depression or rise of the liquid. This thermometer is liable to two objections: the expansibility of air is too great to mark very considerable changes of temperature; and it is liable to be influenced by atmospheric pressure.

*ie's differential thermometer* is a modification of Sanctorio's air thermometer; it consists of a glass tube bent at right angles, and terminating in two bulbs. Both bulbs contain air, but the greater part of the tube is filled with a coloured fluid. So long as the same temperature acts upon both bulbs, no change can take place; but the slightest *difference* between the temperature of the two is detected by the movement of the liquid under the pressure of the air.

Fig. 3.



Liquids are much better suited than gases for thermometers; and of liquids, mercury is the best adapted, on account of the great range between its boiling point, 656°, and its g point, —40°; it is also very sensible to the action of heat; dilatations between 32° and 212° are nearly uniform. The essential parts of a thermometer consist of a tube of a uniform small bore, terminating in a bulb; the ball and part of the tube are filled with mercury, and the air expelled by boiling the mercury, and then hermetically sealing the tube. The *boiling point* is ascertained by immersing the bulb in boiling water; the *freezing point*, by immersing it in melting ice. The distance between these two points is marked in various modes: in Fahrenheit's scale, the freezing point is marked 32°, and the boiling point, 212°; the intermediate divisions being 180 degrees. In the centigrade thermometer (Celsius'), the freezing point is zero, and the boiling point 100°. In Reaumur's, the freezing point is zero, and the boiling point 80°. As the ratio between these three scales is that of 180, 100, and 80, or 9, 5, 4, it is easy to reduce one to the other. The alcoholic thermometer is used when extremely low temperatures are to be measured, alcohol having never been frozen.

The expansibility of the air by heat is the cause of the phenomena of *winds*. The sun's rays falling nearly vertically over the equator, and very obliquely at the poles, produce a very unequal temperature at these points. The air at the equator becoming rarefied, rises and creates a partial vacuum, while the cold air from the poles will rush in to supply its place. In this way two currents are established towards the equator, one from the north, and one from the south pole, besides the upward current. In consequence, however, of the earth's motion upon her axis from west to east, the two currents just alluded to will take an oblique direction from east to west. These winds are called the *trade-winds*.

### COMMUNICATION, OR TRANSFER OF HEAT.

Heat may be communicated to bodies in different modes:—by *contact*, as in the conduction of solids, and the circulation of liquids; by *radiation*, and by *reflection*.

*Conduction of heat.*—By this is meant the passage of heat from one particle of a body to another. This conducting power is very different in different bodies. Metals are the best conductors of heat, but not all equally so; gold is the best conductor, lead the worst; glass and porcelain are worse conductors than the metals. Liquids and gases are nearly destitute of conducting power, as may be shown by applying heat to the top of them; the mode of heating them is to apply the heat at the bottom, when instantly, there are two currents set in motion, the hot particles rising towards the surface, and the colder ones descending: this process is termed *circulation*, or *convection*.

*Radiation of heat.*—That mode by which heat is given off to some distance on all sides, by a heated body, is termed *radiation*; and the heat, *radiant heat*. Heat is emitted from a hot body in all directions, and in straight lines or radii, just as rays of light are l from a luminous body. These calorific rays pass freely h the air, or a vacuum, without sensibly affecting its tempera- When they fall upon the surface of a solid body, they may osed of in three different ways:—1, they may be *reflected;* may be *absorbed;* or 3, they may pass through it, or be *itted.* In the first and third cases, the temperature of the unaffected; in the second case, it is elevated.

radiating power of bodies varies very much; it depends upon the nature of their surfaces, those which are rough and throwing out more heat than those which are smooth and ed; lamp-black is the best radiator, polished metals the worst. alone has no influence upon it.

*lection of heat* resembles reflection of light. It is familiarly by holding a sheet of polished metal near the fire at an angle; the heat will be reflected in the corresponding angle. It may be better shown by placing a red-hot iron ball in the focus of a parabolic mirror; the calorific rays impinging on the mirror, will be reflected, in straight lines; and if another similar mirror be properly adjusted, many feet distant, these rays may be made to converge again in its focus, so as to affect a thermometer placed there, or even to set fire to phosphorus.

g. 4.

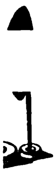
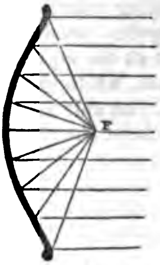


Fig. 5.



s a law, that the best radiators are the worst reflectors, and *rsâ;* but the power of *absorbing* heat is in direct proportion radiating power. The power of absorbing heat has been t to depend upon the *colour* of the substance; but this has uestioned. The laws of radiation explain the formation of the surface of the ground being cooled down after sunset by on, the aqueous vapour existing in the air is deposited in the f dew. If the night be cloudy, however, the rays of heat tercepted by the clouds which reflect them back, and hence r no dew is deposited. It is also well known, that the most radiators, such as grass, wood, leaves, &c., are the most d with dew, while a piece of polished metal, &c., would be y moistened. In the same manner also, the production of d and sea breezes of tropical islands is accounted for.

*nsmission of heat.*—By this is meant the passage of the ca- rays through certain media. Substances which transmit such re called *transcalent,* or *diathermanous;* it may easily be by interposing a piece of plate glass between a red-hot body and a mirror; while all the rays of light will pass through the glass, many of the rays of heat will be arrested by it, so that but a very feeble effect is produced at the focus of the mirror. The only substance perfectly diathermanous is *rock salt;* other media, though entirely transparent, intercept the rays of heat to a greater or less extent. It has also been shown that radiant heat, like light, is capable of being *polarized.*

*Vaporization.*—This signifies the conversion of a solid or liquid into a vapour or gas, by heat. Vapours differ from gases only in being easily compressed into a liquid. Vaporization includes both *ebullition* and *evaporation.* In ebullition, the formation of the vapour is so rapid, that it rises to the surface in the form of bubbles, which then burst; the point at which this takes place is called the *boiling point,* and is always constant under the same circumstances; it varies very much for different liquids: thus, for water, it is 212° F.; for alcohol, 172°; for ether, 96°; for sulphuric acid, 620°; for mercury, 662°. The boiling point is chiefly influenced by the degree of pressure to which the liquid is subjected. On the earth's surface the atmosphere exerts a pressure upon every object of 15 pounds to every square inch; this force must be overcome by the elasticity of the vapour of a liquid before it can boil; hence, as the atmospheric pressure varies, the boiling point must equally vary; hence water will boil at a much lower point on a mountain, or in a partially-exhausted receiver, than at 212°. So constant is the ratio between the depression of the boiling point and the diminution of the atmospheric pressure, that it forms a good method for ascertaining the height of mountains,—a depression of one degree being equivalent to an elevation of about 548 feet. Liquids boil, in vacuo, at a temperature of 140° lower than in the open air. The influence of diminished pressure in depressing the boiling point of a liquid, is shown in the experiment denominated the *culinary paradox.* A small flask of water is made to boil for a few minutes until the steam freely issues from the orifice; when it is firmly corked. On removing it from the heat, the ebullition of course ceases; but it may be made to commence again by simply applying cold water to the upper part of the flask; the cold condensing the vapour, and thereby diminishing the pressure.

On the other hand, the boiling point may be much elevated by increasing the pressure. In this way, water may be prevented from boiling by the pressure of its own vapour—being confined in a strong metallic vessel. There is no limit to the degree to which water may be thus heated, provided the vessel be strong enough to bear the enormous pressure of the vapour thus generated. It is on this principle that the *high pressure* steam engine acts; in it the steam is forced, both before and behind the piston, by means of sliding valves. In *low pressure* engines, a vacuum is created before

hind the piston, by means of a condenser, so that the piston
en into a vacuum, instead of against the pressure of the atmo-
. Other circumstances modifying ebullition are *the nature*
*surface of the vessel*, and *the depth of the column of liquid.*
'st of these depends upon the different degrees of attraction
ing between the vessel and the liquid; the second, upon the
ed pressure produced upon the lower stratum by a very tall
n of liquid.

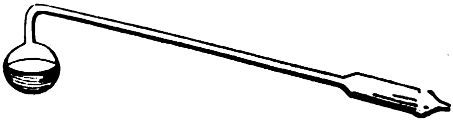
lready mentioned, a large amount of heat is rendered latent,
production of steam.

ubic inch of water, in becoming steam, under the ordinary
re of the atmosphere, expands nearly into a cubic foot.

*poration* differs from ebullition only in being a slower pro-
nd not attended with the appearance of boiling; it occurs
mon temperatures;—takes place in all fluids, and some solids,
phor;—is much more rapid in such as have a low boiling
as ether and alcohol. Evaporation is influenced by 1, extent
ace; 2, temperature:—heat is favourable to it; 3, hygrome-
ite of the atmosphere:—dryness favours it; 4, by a current
; 5, by amount of pressure. The effect of removing the
re is well seen by putting ether under a receiver, and remov-
; the evaporation is so rapid as to produce ebullition.

l is always produced by evaporation, in consequence of the
t of heat which is rendered latent. This is shown by placing
lrops of ether on the hand and exposing it to the air; or
g ether on the bulb of a thermometer, and noting the depres-
i the scale. By means of the cold produced by evaporation,
may be frozen by placing it over sulphuric acid in a receiver,
ickly exhausting the air. The same thing is also shown by
ston's *cryophorus*, or frost-carrier, which consists of a glass
f the figure represented in the cut. The bulb contains water,

Fig. 6.



t of the space being filled with aqueous vapour. The empty
ity being plunged into a mixture of snow and salt, the solidi-
of the vapour gives rise to such a quick evaporation from
face of the water, that the latter freezes.

temperature at which moisture is condensed from the air
cool surface, is called the *dew-point*; it varies according to
iperature and the amount of moisture present. Instruments

for ascertaining the dew-point are called *hygrometers*, the simplest of which is a silver cup containing water, which is to be cooled down till moisture is deposited on the exterior, and then the temperature indicated by a thermometer placed inside.

*Specific heat, or capacity for heat.*—By this is meant the ratio of the heat a body may contain, with the bulk or weight of the body. A simple experiment will prove that different bodies, though exhibiting the same *apparent* temperatures, contain, in reality, very different amounts of heat. Thus, in mixing a pound of mercury at 162°, with a pound of water at 100°, the temperature of the mixture will be 102°; here, the mercury, by losing 60°, raises the water 2°. But if the water be at 162°, and the mercury at 100°, the temperature of the mixture will be 160°; in this case, the water, by losing 2°, raises the mercury 60°. From this it appears that the same heat which would raise water 2°, will raise an equal weight of mercury 60°, being in the ratio of 1 to 30. By a similar experiment in oil and water, it is found that the ratio between them is that of 2 to 1.

There are three different modes of ascertaining the specific heat of various substances. The first is by observing the quantity of ice melted by a given weight of the substance heated to a particular temperature; the second, by noting the time which the heated body requires to cool down through a certain number of degrees; the third is the method of mixture, just pointed out, and is the one usually preferred.

*The spheroidal condition.*—By this is meant the peculiar shape which water and other liquids will assume when thrown upon a red-hot smooth metallic surface. Instead of immediately escaping as vapour, the liquid will play upon the surface in spheroidal globules until the temperature is reduced to 212°, when it will suddenly explode into vapour. This is probably the cause of many steam boiler explosions; becoming red-hot, the water assumes the spheroidal state, and no steam is generated; but on suddenly cooling it down by the admission of more water, instantaneous explosion ensues.

*Means of producing heat.*—It will suffice here merely to mention them; viz., lenses and mirrors, percussion, friction, condensation, combination, electricity, galvanism, fermentation, and vitality.

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## SECTION II.

### LIGHT.

**There** are two theories of Light: one—the Newtonian—is that it consists of infinitely small particles, emitted by luminous bodies;

ıer, that of Descartes,—that it depends upon undulations itted through a highly-elastic medium of extreme tenuity, ın *ether,* just as sound is produced by the undulations of the here.

ıt travels in straight lines in every direction, with extreme y; it occupies about eight minutes in coming from the sun earth, which is at the rate of 200,000 miles in a second.

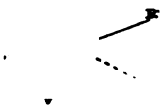
n a ray of light falls on a plane surface, it may either be ab- or reflected, or it may be transmitted through it.

*eflection,* is meant that property which causes a ray of light, g upon a bright surface, to be thrown back, at an angle which ys equal to the angle of incidence.

*action of light,* is where a ray, in passing from one medium ıother of different density, is bent from its straight line. the ray passes from a rarer to a denser medium, it is refract- *ards* a line perpendicular to the surface of the latter; but t passes from a denser to a rarer medium, it is bent *from* a rpendicular to the surface of the denser substance. Different ıces possess different degrees of refractive power; generally ıg, the densest substance refracts most; the same is true also bustible substances.

te light is compound,—that is, it is made up of different d rays, as may be proved by admitting a ray of light through a small aperture into a dark room, and interposing a glass prism; it will not only be refracted from its straight course, but will be decomposed into seven differently-coloured spaces, forming a figure termed the *solar spectrum.* The upper part of the spectrum is red; the lower, violet; ermediate portion, commencing with the violet, being indigo, reen, yellow, and orange, all gradually shading off into each These were termed by Newton the *prismatic* or *primary* , from the impression that they were the elements of white

Fig. 7.



ster's opinion, which is rather the received one at present, is, ere are only *three* primary colours, viz., *blue, yellow,* and *red;* ıt when these are mixed in definite proportions, white light ult; but that when any of them is in excess, then the effect r will be produced. The colours of natural objects are sup- o result from the surfaces of these bodies absorbing certain ıd reflecting or transmitting others; thus an object appears cause it absorbs a portion of the yellow and the blue rays ing the white light which falls upon it, while it reflects the s; it appears *white* when it reflects all the rays, and *black* absorbs them all.

The greatest *illuminating* power of the spectrum is about its middle, or rather, between the yellow and green; the greatest *heating* power is in the red space or beyond it, varying with the kind of prism used; the *deoxidizing* power is greatest in the violet space, or just beyond it. The red ray is the least refrangible; the violet ray the most so.

The *chemical* effects of light are well marked; thus a mixture of chlorine and hydrogen may be kept for any length of time in the dark; but under the influence of light, a combination soon ensues; so the blackening and the decomposition of the salts of silver occur rapidly in the light. But the most remarkable chemical effect produced by light is upon the leaves of growing plants, which then possess the property of decomposing the carbonic acid of the air, appropriating the carbon to themselves, and giving out the oxygen.

Rays of light are *absorbed* much more by some bodies than by others. As a general rule those which absorb radiant heat most, are the best absorbers of light. Colour appears to exercise a great degree of influence over it; dark-coloured substances, for this reason become sooner heated than light-coloured ones.

A ray of light when made to pass through certain kinds of crystals, as Iceland spar, is divided into two, one of which is refracted in the ordinary way, the other taking an extraordinary direction; this is denominated *double refraction.*

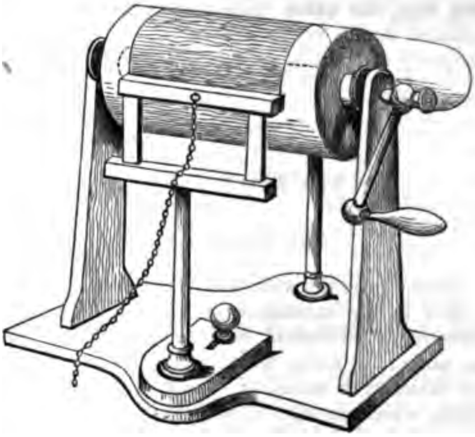
Another property of light is its capability of *polarization.*

## SECTION III.

### ELECTRICITY.

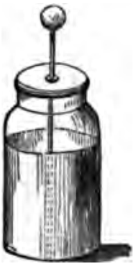
The term *electricity* is derived from the Greek word signifying *amber,* since this is the substance in which electrical excitement was first discovered. Electrical excitement may be produced by rubbing glass, amber, or resin, which will then attract light bodies. There are two varieties or states of electricity, the *vitreous,* or that excited in glass, which is also called *positive* electricity, and the *resinous,* or that excited in resins, called also *negative* electricity. The difference between these may be easily shown by suspending a light pith-ball, or a feather, by means of a thread of silk; then on exciting a dry glass tube and presenting it to it, the body will be attracted, but after a few moments it will be repelled, in consequence of receiving electricity from the glass tube; if now, a stick of resin properly excited be presented to it, it will be attracted; but after ng the resin and receiving some of its electricity, it will soon elled by it; but on the other hand, attracted by the glass. xperiment establishes the law "that bodies similarly electri- epel each other, but dissimilarly electrified they attract." icians divide bodies into *electrics*, or *non-conductors*, as glass, sulphur, &c., and *non-electrics* or *conductors*, as the metals, &c. The essential parts of the *electrical machine*, are, 1, the , which is usually a glass cylinder or plate, contrived so as apable of turning by means of a handle; 2, the *rubber*, which uffed cushion covered with an amalgam of tin, zinc, and mer- gainst which the electric is rubbed; 3, the *prime conductor*, is a metallic cylinder armed with a number of points for the erfect collection of the electricity. Both cushion and con- should be *insulated*, that is, supported on a pedestal of glass is a non-conductor. The cylinder, as it turns, becomes charged ositive (vitreous) electricity, by friction against the cushion, as quickly discharged, by the rows of points, into the prime tor, which, as it is insulated, thus acquires a charge of posi- ctricity, which it will yield up on contact with any body, peculiar noise and spark. The maximum effect is produced he rubber is made to communicate with the earth by means ain. If *negative* electricity be wanted, the conductor must e to communicate with the earth, and the rubber insulated, ctricity being drawn from the latter.

Fig. 8.



The *Leyden jar* is an instrument for *accumulating* electricity. It depends on the principle that a large amount of the two different sorts of electricity may reside on the two surfaces without any tendency to equilibrium, on account of the non-conducting power of the glass. It consists of a thin glass jar coated on both sides with tin foil, to within a few inches of the top; a wire, terminating in a metallic knob, communicates with the interior coating. When the outside coating is connected with the earth, and the knob placed near the prime conductor of the machine, the inner and outer surfaces become respectively positive and negative. If, now, the two coatings be made to connect by means of a bent wire, the equilibrium is restored, a bright spark is perceived, along with a sharp snap, and if the body be interposed, the *electric shock* is felt.

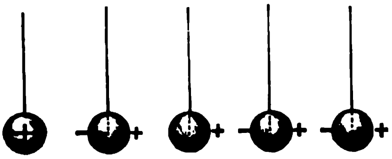
Fig. 9.



The *electric battery* is only a great number of such jars connected together by their inner and outer coatings respectively; the whole then act as one very large jar, by which great extent of surface and an enormous accumulation of electricity are gained; the whole may be discharged at the same moment, and the effect is, of course, exceedingly powerful.

By *electrical induction* is meant the power which an electrified body has to produce an opposite electric condition in a contiguous body; it is by virtue of this law, that when an electrified body, as a glass tube previously rubbed, approaches a light body, as a feather or pith-ball, it immediately *attracts* it, having first *induced* in it an opposite electrical state. A series of globes suspended by silk threads, in the manner represented, will each become electric by *induction*, when a charged body is brought near the end of the series. The positive and negative signs are intended to represent the *states*.

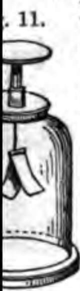
Fig. 10.



The electrical state of the atmosphere is liable to disturbance: experiment has shown that the higher regions of the air are usually in a positive state: in cloudy and stormy weather, the clouds near the surface often appear in a negative state. In a thunder-storm, the cloud and the earth may be considered as representing the two coatings of the Leyden jar, differently electrified,—and the intervening air, the bad conducting glass. The dangerous effects of lightning are much lessened by the use of *lightning rods*, which are

ic conductors terminating above in a point, and below passing
nsiderable depth into the earth. The object of the *pointed*
ity is to conduct off the discharge silently; a blunt extremity would give rise to a spark, and perhaps a shock, which might be unsafe; this may be easily shown by experiment with the electrical machine.

. 11.



*Electrometers* and *electroscopes* are instruments for indicating, or measuring the electrical intensity. The most simple one is that named the *gold leaf electrometer;* it consists of a pair of gold leaves suspended from the top of a bell-jar and communicating above with a metallic cap. When an electrified body is brought near the cap, its presence is immediately detected by the divergence of the gold leaves. There are other electrometers known by the names of *quadrant electrometer*, *torsion electrometer*, *balance electrometer*, &c.

o theories of electricity have long been maintained. One is
*eory of two fluids*, which supposes two distinct kinds of elec-
, and that these exist in all substances, the one named
*us*, because developed in glass, the other *resinous*, because mani-
in resins; that these two fluids neutralized each other, and
ved an equilibrium in bodies at rest; but that when this equili-
was disturbed by friction, &c., one or other kind of electricity
isplayed. The other is *the theory of a single fluid*, or that of
lin. It supposes all bodies to possess it in a certain amount,
at their equilibrium is constantly liable to disturbance by fric-
&c.; that when it is in excess, it is *positively* excited; when
iciency, it is *negatively* excited; and that there is a constant
ncy to an equilibrium.

## SECTION IV.

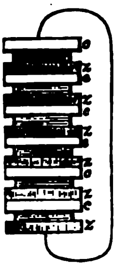
### GALVANISM, OR VOLTAIC ELECTRICITY.

IEN two solid bodies, as two pieces of metal, are plunged into
id capable of acting upon them unequally, the electric equili-
is disturbed, the one acquiring the positive condition, and the
the negative. Thus, a piece of zinc and a piece of copper,
l in a dilute solution of sulphuric acid, will cause such a dis-
nce of the electrical equilibrium; the zinc being the metal
ttacked, becomes *negative*, while the copper becomes *positive;*
n making a communication between the two, an electrical
nt is set in motion. The intensity of the electricity thus de-
ed is extremely feeble; but by arranging a number of single
of metals with the intervention of a fluid, or moistened cloth,
h a manner that the direction of the current shall be the same

in each, the intensity will be very much augmented; upon this principle the *Pile of Volta* and the *Crown of Cups* are contrived.

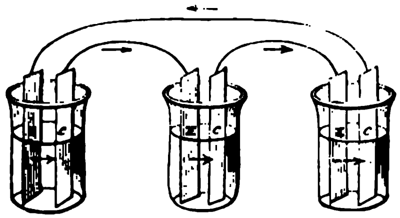
The *Voltaic pile* consists of a number of small plates of zinc and copper arranged in a pile, each pair being separated by means of a piece of cloth moistened with sulphuric acid, as seen by the figure. If the two terminal plates be now touched with wet hands, a prolonged electric shock will be experienced, the intensity of which may be increased to almost any extent, by simply increasing the number of plates.

Fig. 12.



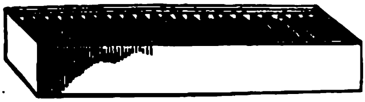
The *Crown of Cups* is similar in principle, though different in form; it consists of any number of cups or glasses, arranged in a row or circle, each containing a piece of copper and zinc, and some dilute acid. The copper of the first cup is connected with the zinc of the second; the copper of the second, with the zinc of the third, and so on; on establishing a communication between the first and last plates, a discharge takes place as before.

Fig. 13.



Whenever such an arrangement consists merely of a single pair of conductors, and an interposed liquid, it is called a *simple circuit;* when two or more alternations are concerned, it is a *compound circuit;* but however complex the apparatus may be, the principle is, in all cases, precisely the same. The disturbance of the equilibrium may be considered as commencing at the surface of the most oxidizable metal, and to be propagated through the liquid to the least oxidizable metal; hence, when insulated, the zinc end of the series is always negative, and the copper end positive. When the two extremities are joined, the current continues to pass from the copper to the zinc; so that in fact, we may consider that there are two currents: one, *in* the battery, passing from the zinc to the copper; the other *out* of the battery, going from the copper to the zinc, as shown by the arrows in the preceding figure.

Fig. 14.



*Cruikshank's trough* is a modification of Volta's pile; it consists of numerous pairs of zinc and copper plates soldered together, and cemented water-tight into a mahogany trough, which thus becomes divided series of cells or compartments, capable of receiving the ex- liquid. This apparatus is well adapted to exhibit effects of , and give shocks.

*quantity* of electricity set free, is to be distinguished from its ; the first is measured by its *chemical* effects—particularly wer of decomposition, and depends on the surface; the last, power of overcoming obstacles, and passing through imperfect tors; it depends on the number of plates. The energy of a current is measured by the deflection of a magnetic needle.

*erent theories as to the nature and cause of galvanism.*—Gal- pposed it to be developed in the animal upon which he was nenting, and that the metals served merely as conductors; on the other hand, supposed it to be developed by the con- dissimilar metals. Subsequently, Faraday brought forward ory of *chemical action,* which is now most generally adopted. most important effect produced by galvanism, is that of the position of compound bodies. It was by means of this agent r H. Davy made the discovery of the metals of the alkalies. compound bodies in the fluid state are traversed by a galvanic a decomposition usually takes place according to a uniform nstant rule; certain elements, as oxygen, chlorine, iodine, c., appearing at the positive or *zinc* end of the battery, and as hydrogen, the metals, &c., at the *copper* or negative end. the division of bodies by chemists according to their electri- itudes; those which go to the positive pole being called *elec- ative,*—at the head of which stands oxygen; and those which he negative pole being called *electro-positive,* of which, hydro- the first.

*electrodes* or *poles* of a battery are the points of the circuit y the extremities) where the electrical phenomena are mani- The decomposition of a fluid by galvanic action is termed *ysis;* and the liquids which are capable of being thus acted named *electrolytes.*

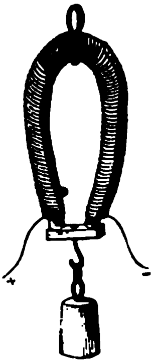
*nstant* battery is one which preserves its power of action for an ite time. The common zinc and copper battery soon loses er, from the fact that the sulphate of zinc gradually formed gradually decomposed by the hydrogen constantly evolved copper plate, on which the reduced metallic zinc becomes de- , converting, as it were, the copper into a zinc plate. Va- nstant batteries are in use, as Daniel's, Children's, Grove's, &c.

*netic effects of galvanism.*—Among the effects of galvanism, ence over the magnet is very remarkable. Although the d been long known that electricity was capable of inducing troying magnetism, as witnessed in the effects of lightning compass-needle, it was not until the year 1819 that the laws phenomena were established by Œrsted, and the science of *electro-magnetism* truly developed. It is found that if a galvanic current be set in motion near a magnetic needle, the latter will arrange itself across the current, so that its axis may be perpendicular to the wire.

To ascertain the direction of a current, or the deflection of a needle, the following simple plan will assist: let a person suppose his own body to be the conducting wire, and to be placed in its position; then, while looking at the marked pole, and the current is passing from his head to his feet, it will be deflected to the right hand; if from his feet to his head, to the left hand.

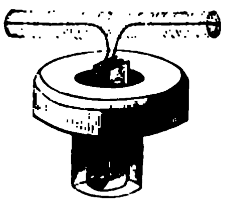
When an electric current is passed at right angles to a piece of iron or steel, the latter acquires magnetic polarity, either temporary or permanent; the direction of the current determining the position of the poles. This effect is very much increased by causing the current to circulate a number of times around the bar, which soon acquires extraordinary magnetic power. A piece of soft iron in the form of a horseshoe, surrounded thus by a coil of copper wire, insulated by being covered with silk, may be made to become so highly magnetic, simply by connecting the two ends of the iron with a small battery of a single pair of plates, as to be capable of sustaining a very heavy weight.

Fig. 15.



As electricity can produce a magnetic influence, in the same manner it is found that magnetism can call into activity electric currents. If the two extremities of the coil of the electro-magnet just described, be connected with a galvanoscope, and the iron magnetized by the application of a steel horseshoe magnet to the ends of the bar, a momentary current will be developed in the wire, and pointed out by the movement of the needle. On removing the magnet, whereby the polarity of the iron is at once destroyed, a second current will become apparent, but in the opposite direction to that of the first. By using a very powerful steel magnet, surrounding its iron keeper or armature with a very long coil of wire, and then making the armature itself rotate in front of the faces of the magnet, so that its induced polarity shall be rapidly reversed, magneto-electric currents may be produced of such intensity as to give bright sparks, and powerful shocks, and exhibit all the phenomena of voltaic electricity. The accompanying figure represents such an arrangement.—There is a great variety of form in electro-magnetic machinery; but in all,

Fig. 16.



ie most complicated, the *essential principle* is the same, viz.:
velopment of an electrical current by magnetic action.

earth is supposed to be a great magnet, having electric circles
ing it at right angles from east to west, and having its north and
pole corresponding to its respective geographical poles; hence
rth pole of a magnet should really be considered its south
nd *vice versâ*, because opposite poles attract. For this reason
les of a magnet are now often named the *marked* and *un-*
*d* poles.

ias lately been announced by Faraday, that oxygen gas is
magnetic.

# PART II.

## INORGANIC CHEMISTRY.

## CHAPTER I.

### LIMINARY REMARKS ON CHEMICAL NOMENCLATURE, AFFINITY, ETC.

TERIAL substances are divided by the chemist into *simple* or
*tary*, and *compound*. The simple bodies are such as have as
isted all efforts to decompose them. Compound bodies are
hat may be resolved into two or more elements. It is possi-
it some bodies at present regarded as elementary may here-
rove to be compound, as was the case with the alkalies.

number of simple bodies recognised by chemists at the pre-
ay is sixty-two; of these, forty-nine belong to the class of
, and thirteen to the class of non-metallic bodies.

### CHEMICAL NOMENCLATURE.

he formation of a chemical nomenclature, the names given to
of the elements were expressive of some of their striking
tics:—thus *oxygen*, from two Greek words, signifying to pro-
n acid, from the idea that oxygen was the sole acidifying prin-
*hydrogen*, from two words signifying to produce water;—
again derived their names from words expressive of their
as chlorine, iodine, cyanogen, &c. The compounds of oxygen
amed *oxides* or *acids*, according as they do, or do not possess
. Acids derive their name from the substance acidified by
ygen, by the termination in *ic;* thus sulphur*ic*, carbon*ic*,
or*ic*, &c. Should the substance be capable of forming more
ie acid, the name of that containing least oxygen is made to
ite in *ous*, as sulphur*ous*, nitr*ous*, &c. When the same sub-
forms several acids with oxygen, the Greek preposition *hypo*

is generally prefixed to express the relative quantity of oxygen; thus, *hypo*nitrous and *hypo*sulphuric indicate acids containing less oxygen than nitrous and sulphuric acids respectively; sometimes the particle *per* is prefixed to express the highest amount of oxygen, as *per*chloric acid.

The nomenclature of the *salts* is made to depend on the termination of their acid; thus, acids ending in *ous* form salts terminating in *ite*, as sulph*ite*, nitr*ite*, from sulphur*ous* and nitr*ous* acids; acids ending in *ic*, as sulphur*ic* or nitr*ic*, form salts terminating in *ate*, as sulph*ate* and nitr*ate*.

The termination of names of compound bodies is directed chiefly by analogy; thus the non-acid compounds of chlorine, iodine, bromine and fluorine, from the analogy of these bodies with oxygen, are named chlor*ides*, brom*ides*, iod*ides*, &c. The compounds of the inflammables terminate generally in *uret*, as carb*uret*, sulph*uret*, phosph*uret*, &c.

Different *oxides* of the same metal are distinguished by the numerals prefixed. The oxide containing a single equivalent of the metal and oxygen is named *pro*toxide; that containing the greatest amount of oxygen, the *per*oxide; the intermediate oxides are expressed by Latin numerals, as the *deut*oxide or *bin*oxide, *ter*oxide or *trit*oxide, &c.; the Greek numerals, *dis*, *tris*, &c., prefixed, denote oxides containing one equivalent of oxygen with *two*, *three*, or *more* equivalents of the metal; thus, the *di*oxide of copper. A *sub*oxide signifies an oxide containing less oxygen than a protoxide.

The same system is also extended to salts, where there is more than one formed by an acid with the same base. When the salt is *neutral* it is simply named according to the nature of the acid, as sulphate, or nitrite; if it contains two equivalents of the acid, it is named a *bi*sulphate, or a *bi*carbonate, &c. If it contains two equivalents of the base, it is named a *di*sulphate, &c. The term *sesqui*, (one and a half), is used to indicate the relation of 1 to 1½, or 2 to 3, as in the sesquioxide of iron, a compound consisting of two eq. of iron and three of oxygen.

The generic part of the name of a compound is usually formed from that ingredient which is the most electro-negative; thus in compounds formed between oxygen, chlorine, iodine and sulphur, we say oxide of chlorine, chloride of iodine, iodide of sulphur; and not chloride of oxygen, iodide of chlorine, or sulphuret of iodine.

It is often, however, very difficult to apply appropriate names to the highly-complex bodies of the organic world; in which cases more particularly, the use of chemical signs or *symbols* becomes very advantageous, as will be briefly shown.

Every elementary substance is designated by the first letter of its Latin name, in capital, or by the first letter conjoined with a second small one most characteristic, since the names of many bodies begin

thus, Aluminium, Al.; Arsenic, As.; Bromine, Br.; Boron,
arium, Ba.; Carbon, C.; Chlorine, Cl.; Hydrogen, H.;
, I.; Iron (ferrum), Fe.; &c. It is always understood that
ymbols express *one equivalent of the substance.*

bination between bodies is expressed by a mere juxtaposition
symbols, or sometimes by interposing the sign +: thus water
essed by HO, or H+O; hydrochloric acid, by H Cl, or H+Cl;
ide of iron, by FeO, or Fe+O.

en more than one equivalent is intended, the number is either
d to the symbol, or else placed after it: thus, sulphuric acid,
, or $SO^3$, or $SO_3$; hyposulphuric acid, 2S+5O, or $S^2O^5$, or
tc. Sometimes abbreviations are made use of: thus, two
lents of a substance are indicated by the symbol with a short
awn through or below it; an equivalent of oxygen is signified
ot, and one of sulphur by a comma, thus sesquioxide of iron,

isulphuret of carbon, $\overset{,,}{C}$, instead of $CS_2$.

umber placed before a compound multiplies all that follows
compound; thus, the formula expressing three equivalents of
phate of the sesquioxide of iron is written $3\,(Fe_2O_3+3SO_3)$.

### CHEMICAL AFFINITY.

is the attraction existing between the heterogeneous elements
pound bodies, whilst *cohesion* is the attraction between homo-
s particles. In water and sulphuric acid, for instance, both
ınd bodies, the chemical affinity is exerted between the oxygen
'drogen in the one case, and between the sulphur and oxygen
other. The most simple case of chemical affinity is where
dies unite together to form a third body; as copper and zinc
g brass; sulphuric acid and soda to form sulphate of soda.

second case of affinity, called *single elective attraction,* is
two heterogeneous bodies having united together to form a
ınd, another body, being blended with them in solution,
with one of the former; for example, potash being added to
ion of sulphate of magnesia, unites with the sulphuric acid,
ecipitates the magnesia; water on being added to the tincture
phor (camphor and alcohol), will unite with the alcohol and
tate the camphor.

third case of affinity, called *double elective attraction,* is
two compound bodies, on being intimately mingled, undergo
al decomposition, the four components interchanging places:
solution of acetate of lead and a solution of sulphate of zinc,
ıg mixed, give rise to an acetate of zinc and a sulphate of

*fourth* case of affinity is where two bodies being in combina-
third, on being added in excess, combines with both the

others; thus, ammonia being added to the solution of sulphate of copper, at first throws down the oxide of copper; but on continuing to add the ammonia, the excess combines with the precipitated oxide, which is then redissolved.

*Circumstances modifying chemical affinity.*—One of these is *heat;* thus, by heating mercury in the air, it will combine with oxygen; and by simply increasing the temperature, it will separate again from the oxygen. Another modifying agent is *solution:* many substances which, when in the dry state, evince no tendency to unite, when moistened or dissolved, exhibit a powerful affinity; thus tartaric acid and a carbonated alkali may be kept together, if dry, without any union; but if moistened, effervescence takes place. *Mechanical division* also greatly promotes chemical action, by overcoming cohesion, as may be seen by the action of nitric acid on a brass ball being far less violent than when the metal is presented to it in the form of filings or leaves. The *nascent state* is also peculiarly favourable to chemical combination.

*Tables of affinity* consist of a series of substances placed in a column, in the order of their affinity for any one substance at the head of the column, as in the following example:

*Sulphuric Acid.*

Baryta,
Strontia,
Potash.
Lime,
Magnesia,
Ammonia.

*The Atomic Theory.*—The doctrine of *atomic weights* and *chemi-*
*equivalents* is based upon the supposition that every substance is
ible into ultimate particles termed *atoms*, which atoms unite
ther in certain definite proportions to form various compound
s.

e *Chemical Equivalent* of a body is the number expressing its
*combining proportional;* as these merely express the ratio,
ne body may be selected as a standard; either oxygen or hy-
n are generally employed,—more frequently hydrogen,—which
placed at unity, the *equivalent number* or *chemical equivalent*
gen would be 8; since eight atoms of oxygen always unite
e of hydrogen. In the same way the equivalent of chlorine
n fixed at 36; that of nitrogen at 14; that of iron at 28;
on. An atom of a compound body will of course be com-
s an atom of water, or of sulphuric acid; so also, the *che-*
*uivalent* of a compound body is the sum of the equivalents
nstituents; thus the equivalent of water is 9 (8+1); that
ric acid 40 (16+24); and so on.

# CHEMISTRY.

## LAWS OF CHEMICAL COMBINATION.

ll chemical compounds are fixed and definite in their nature, io of the elements being constant. This is termed the *law ite proportions.*

*he law of multiple proportions.*—When any body is capable ting with a second in several proportions, these proportions simple relation to each other. This is well illustrated in ries of compounds of nitrogen and oxygen, in which, while trogen remains the same, the quantities of oxygen increase ltiples of 8; thus 8, 8×2, 8×3, 8×4, 8×5 give respectively antities of oxygen contained in the protoxide of nitrogen, the ide, hyponitrous acid, nitrous acid, and nitric acid.

*he law of equivalents.*—The proportions in which several unite with any given body represent the relations in which nite among themselves. Take oxygen as an example: the tions in which sulphur, chlorine, carbon, and iron unite with , are respectively 16, 36, 6, and 27, for every 8 parts of . Now, according to the above law, these bodies will com- ith each other in the same proportion,—thus carbon and in the ratio of 6 to 8, &c. These proportions are named *lents* or *combining* numbers. The law holds equally true for und bodies.

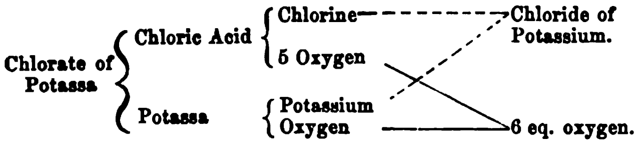
obvious that any body may be assumed as unity; generally en is so assumed, in which case the equivalent of oxygen is 8.

## SECTION I.

## SIMPLE NON-METALLIC BODIES.

### OXYGEN.

STS abundantly in nature, constituting one-fifth of the atmo- , and eight parts in nine of water; also, in all organic matter. overed in 1771 by Priestley, and by Scheele in 1775; named *isticated air* by Priestley, *empyreal air* by Scheele, and *vital* Condorcet;—the name *oxygen*, derived from two Greek signifying to *generate an acid*, was given by Lavoisier, under a that it was the sole acidifying principle.—*Prepared* by either the peroxides of mercury, lead, or manganese, or the or chlorate of potassa. When either of the peroxides is exto heat, a portion of their oxygen is driven off, and they are ted into either protoxides or sesquioxides. Perhaps the best f procuring it is to heat the chlorate of potassa, which yields quantity of oxygen,—the gas coming both from the acid se, and the salt becoming converted into the chloride of po- . This is shown by the following diagram:



If a little powdered peroxide of manganese be previously mixed with the chlorate of potassa, a less amount of heat will be required, although none of the oxygen comes from the manganese. Oxygen should be collected over water, in a *pneumatic trough*,—a large vessel containing water, and fitted with a shelf for holding the receivers, which must always be below the level of the liquid.

*Properties.*—Colourless, tasteless, inodorous; sp. gr. 1·1026;—has never been condensed into a liquid; it is the most perfect negative electric; is very sparingly soluble in water; a powerful supporter of combustion and of life; has a strong attraction for most simple bodies. Its power of supporting combustion is shown by immersing in it a candle with a red-hot wick, which is instantly relighted; or by the burning of fine iron wire, or of phosphorus and sulphur, in it; the compounds which are always thus formed are termed either *acids* or *oxides*, according as they do, or do not, possess acid properties. *Ordinary combustion* is only the rapid union of a body with oxygen; and the body, when burnt, is always increased in weight; which increase is exactly equal to the amount of oxygen which has disappeared. Oxygen is equally essential to respiration: no animal can live in an atmosphere deprived of oxygen; pure oxygen is injurious to life, on account of its highly-stimulating properties, all of the functions becoming extremely excited. Eq.=8;—combining vol.=50;—Symbol, O.

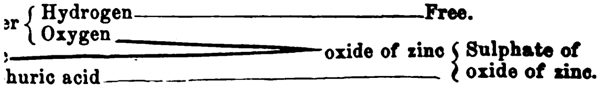
*Theory of combustion.*—The term *combustion*, in its widest sense, signifies "a chemical combination, attended with the evolution of light and heat." In its *restricted* sense, it means "the rapid union of a combustible with oxygen." Before the discovery of oxygen gas, the phenomena of combustion were explained on the *Stahlian*, or *phlogistic theory*, that all combustibles contained a principle named *phlogiston*, to which they owed their combustibility; and that when they burned, they gave out their phlogiston, and then ceased to be combustible. A metallic oxide was consequently regarded as a simple substance, and the metal itself as a compound of the oxide with phlogiston.

Lavoisier proved the incorrectness of this doctrine, by showing that a body on undergoing combustion, so far from giving out anything, always acquires oxygen; thus, on burning a piece of phosphorus in oxygen, some of the gas disappeared, the phosphorus increased in weight, and the increase of the latter was precisely equal to the loss of the former. Lavoisier, however, went too far

ɔosing that oxygen was the *sole* supporter of combustion;
has been proved that other gases, as chlorine, cyanogen, &c.,
ιo support it. He also accounted for the intense light and
oduced during combustion, on the principle of latent heat;
this he was subsequently proved to be incorrect. No certain
ation of these phenomena have indeed been given, though
ave been attributed to *chemical action* by some, and to *elec-*
by others; this latter view is adopted by Berzelius.
ɔombustibles do not emit an equal amount of heat on being

### HYDROGEN.

ts abundantly in nature; constitutes one-ninth by weight, of
and two-thirds by volume; named from the Greek words sig-
; *to generate water*. *Prepared*, always by decomposing water,
may be effected either by bringing steam in contact with red
n, which then combines with the oxygen of the water, libe-
pure hydrogen; or by the action of dilute sulphuric acid on
of zinc or iron; in this case the water of the sulphuric acid
ts oxygen to the zinc, and its hydrogen escapes: the oxide of
the same time unites with the acid to form the *sulphate of*
ius:—



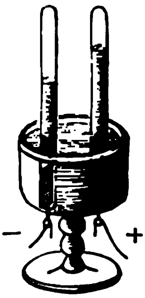
ɔ.—Colourless, inodorous, tasteless; the lightest body in na-
ρ. gr. 0·06896; 100 cubic inches only weigh 2·137 grs. It
be compressed into a liquid; a non-supporter of combustion
spiration, though this latter property arises, not from any
s property of the gas, but only from an absence of oxygen; it
ly inflammable, burning with a pale bluish flame; when mixed
due proportion of oxygen (2 measures of hydrogen to 1 of
), it explodes violently, either by a heated body, or the elec-
ırk, giving rise to the formation of water.
ıgy platinum is instantly made red hot by a jet of hydrogen,
in its turn, is then inflamed;—a mixture of hydrogen and
, will burn slowly without explosion, when the temperature
ɜd a little above that of boiling mercury. The burning of
en with oxygen is accompanied with the evolution of a great
of heat; on this principle the *oxy-hydrogen blowpipe* is
cted, consisting of an apparatus by which a mixture of hy-
and oxygen is made to burn from a jet, care being taken to
against the danger of explosion, by means of Hemming's
ube; the heat thus produced is sufficient to melt the most

refractory metals. A burning jet of this when thrown upon a piece of lime constitutes the *Drummond light.*—Symb. H ;—Eq. 1.

Hydrogen forms two compounds with oxygen : water, or the *protoxide*, and the *peroxide*.

*Water*, HO.—First proved to be composed of hydrogen and oxygen, by Cavendish; this may be shown *synthetically*, by mixing one volume of oxygen with two of hydrogen, and exploding the mixture, when water will be the sole product,—or, *analytically*, by decomposing water either by a red-hot iron, or by galvanism; in the last case, a small portion of water is interposed between a pair of platinum plates connected with the extremities of a voltaic apparatus of moderate power; pure oxygen gas is evolved at the positive plate (or that connected with the copper end), and pure hydrogen at the negative, or zinc extremity; the gases may be properly collected and measured.

Fig. 17.



The composition of water is, by weight, 8 parts of oxygen, and 1 of hydrogen; by volume, 1 volume of oxygen, and 2 of hydrogen.

*Prop.*—Colourless, inodorous, tasteless; a powerful refractor of light; an imperfect conductor of heat and electricity; very incompressible; sp. gr. 1. It does not occur, in nature, chemically pure; can only be procured pure by distillation. Freezing point, 32° F.; boiling point, 212° F.; greatest density, at 40° F. Water acts powerfully as a chemical agent, both as an acid and as a base; in the first case, forming compounds termed *hydrates*, when sometimes the reaction is accompanied with the evolution of heat, as in the slaking of lime; in the second case, uniting with the so-called acids; dry sulphuric acid can evince no acid properties, unless water be present to act as its base, but this base may be substituted by a more powerful one, as the oxide of iron, or of zinc. Water also enters into the composition of many crystals, constituting their *water of crystallization*. Its *solvent* properties are pre-eminent. Water in its natural state always contains atmospheric air, as may be shown by placing it under a receiver and exhausting the air; bubbles of gas will make their escape. Recently-boiled water has the property of absorbing gases, though in different degrees.

*Peroxide of Hydrogen*, $HO_2$, called also *oxygenated water*, is procured from the peroxide of barium, by the action of dilute hydrochloric acid, and then precipitating the baryta by sulphuric acid; the excess of oxygen of the peroxide, instead of escaping, unites with the water, converting it into the peroxide of hydrogen.

*Prop.*—A colourless, transparent liquid; inodorous; has a metallic taste; sp. gr. 1·45; remarkable for its proneness to decomı,—a temperature of 212° causing explosion; it also bleaches idizes.

## NITROGEN.

ıtitutes about four-fifths of the atmosphere, and is found ntly in nature, under various combinations. It may be pro- ı several ways, of which the most simple is to burn out the oxygen from a confined portion of air, in a bell-glass inverted over a dish of water, by means of a piece of phosphorus; the phosphorus is converted into phosphoric acid, and the remaining gas is tolerably pure nitrogen. A purer gas may be obtained by passing atmospheric air over copper heated to redness; or by passing chlorine through a solution of ammonia (nitrogen and hydrogen);—in this last case there is a risk of the formation of the chloride of nitrogen, a very explosive compound.

ig. 18.

*Prop.*—Distinguished for its negative properties; destitute of colour, taste, and smell; a non- ter of combustion and life; has no noxious properties; is not nable; sp. gr. ·972; Eq. = 14·15; Symb. N.

ogen forms five compounds with oxygen, and one mixture, he atmosphere.

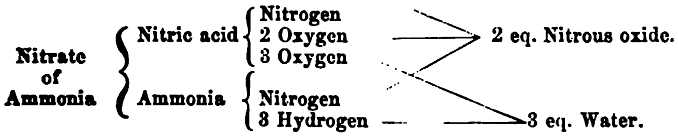
*atmosphere* is composed of about four-fifths of nitrogen, one-' oxygen, and some carbonic acid and watery vapour. The y be analyzed either by burning a piece of phosphorus in a portion of it, or by passing it over a finely-divided copper, to redness, or by mixing it with hydrogen in definite propor- ınd exploding the mixture by the electric spark; the last l is best accomplished by means of a *eudiometer*—a stout ıbe, so arranged that known bulks of gas can be measured. ıe 100 measures of atmospheric air be mixed with 50 of ;en, and the mixture exploded; the volume, after explosion, ɜ found reduced to 87 measures; hence there has been a .tion of 63 measures, of which one-third, or 21 measures, is ı; the remaining two-thirds is hydrogen.

ɔ.—Colourless and invisible; when pure, has no taste or sp. gr. 1; it is 800 times lighter than water at 60°. At ʳel of the sea, it exerts a pressure of 15 pounds on every inch, and is capable of supporting a column of water 34 feet nd one of mercury 30 inches; that is, a column of mercury h square and 30 inches long, has the same weight (nearly 15 ) as a column of water 34 feet long, and as a column of air .l base reaching to the extreme limit of the atmosphere.

## COMPOUNDS OF NITROGEN WITH OXYGEN.

These are Protoxide of Nitrogen, Deutoxide of Nitrogen, Hyponitrous Acid, Nitrous Acid, and Nitric Acid.

*Protoxide of nitrogen*, NO, called also *nitrous oxide*, and *laughing gas*;—prepared by heating the nitrate of ammonia. The rationale is as follows:



*Prop.*—Colourless, transparent, almost inodorous; sp. gr. 1·5; a powerful supporter of combustion; water dissolves nearly its own volume; may be condensed into a liquid at 45° by a pressure of 50 atmospheres; when mixed with hydrogen in equal volumes, it explodes with violence by the electric spark, liberating its own measure of nitrogen. Its most remarkable property is its exhilarating effect on the animal system, when respired.

*Deutoxide*, or *Binoxide of nitrogen*, $NO_2$;—prepared by the action of nitric acid on copper turnings; part of the oxygen of the acid combines with the copper, the oxide thus formed uniting with the undecomposed nitric acid; another portion of the oxygen unites with the nitrogen to form the deutoxide. It is colourless, but has a strong affinity for oxygen; it acquires a dark red colour when it comes in contact with the air, which will serve to distinguish it; it is irrespirable; a supporter of combustion in some cases,—as of charcoal and phosphorus; but it extinguishes a lighted candle. From its affinity for oxygen, it may be used with advantage in *eudiometry*.

*Hyponitrous acid*, $NO_3$; prepared by adding four measures of deutoxide of nitrogen to one of oxygen, and exposing the mixture to a temperature of 0° F.; they condense into a thin liquid of a greenish colour;—vapour, orange red; it is decomposed by water into nitric acid and deutoxide of nitrogen; it cannot be made to unite *directly* with metallic oxides.

*Nitrous acid*, $NO_4$, is always formed whenever deutoxide of nitrogen comes in contact with the atmospheric air, producing dense orange-coloured fumes;—procured in a liquid form by heating nitrate of lead in a retort; oxide of lead remains behind, and the acid is resolved into a mixture of oxygen and nitrous acid, the latter being condensed into a liquid by surrounding the receiver by a powerful freezing mixture.

*Prop.*—At a low temperature it is nearly colourless; acquires an orange tint on raising the temperature; sp. gr. 1·451; very volatile, boiling at 82°;—is acid, pungent, and corrosive; is decomposed, on dded to water, into nitric acid and deutoxide of nitrogen; espirable; supports the combustion of a burning taper and sphorus, but extinguishes sulphur;—a powerful oxidizing

ous acid combines with nitric acid, which thereby acquires a orange tint, and constitutes the fuming-red *nitrous acid* of ps, and the *nitroso-nitric acid* of Berzelius. The colour of xture varies with the strength of the nitric acid, becoming green, and blue, and finally disappearing altogether, as the y of water in the acid increases.

*ic acid*, $NO_5$;—procured synthetically, by passing a succession tric sparks through a mixture of nitrogen and oxygen confined be;—best prepared by the action of sulphuric acid on nitre e of potassa) with the aid of heat; nitric acid vapours pass ong with water, and the bisulphate of potassa remains in the this constitutes the *aqua fortis* of commerce.

.—When thus procured, liquid nitric acid is of a yellowish which is dependent upon some nitrous acid fumes; when ly pure it is colourless; sp. gr. about 1·5; contains about 25 t. of water, without which it cannot exist as an *acid*, though lately been isolated in a dry crystalline form; emits dense, suffocating fumes when exposed to the air; boils at 187°. ding different portions of water to the strong acid, several combinations of acid and water appear to be generated, reble for the difference observed in their boiling and freezing

nitric acid of commerce is apt to contain traces of sulphuric drochloric acids; the former is detected by adding chloride ium—an insoluble sulphate of baryta being precipitated; the by nitrate of silver—an insoluble chloride of silver being down. Nitric acid is a powerful oxidizer, acting with great e on many of the metals; it decomposes all organic sub, and acts on the skin as a caustic. The salts formed by cid are termed *nitrates*.

best tests for nitric acid are,—its solvent power over gold, if hloric acid be present; the formation of the well-known of potassa; the red tint communicated to a salt of morphia; e bleaching effect upon a boiling solution of sulphate of inrovided no chlorine be present.

## CARBON.

is a very abundant product of nature, being a constituent of nic bodies; its purest form is the diamond, a native crystal n; which is proved to be pure carbon by burning it in oxys, the sole product being carbonic acid. The next purest variety is graphite or plumbago, which also contains some iron; next to this comes anthracite coal. It is the essential ingredient of common charcoal, which is prepared by burning wood in close vessels. *Coke* is the charcoal of bituminous coal; *lamp-black*, that of resin; *ivory-black* or animal charcoal is prepared from bones.

*Prop.*—Carbon, as it exists in the diamond, is the hardest substance in nature; it crystallizes in the form of the octohedron or cube; sp. gr. 3·52; is very unchangeable; bears an intense heat in close vessels without fusing; is not acted on either by acids or alkalies. As obtained from wood, it is hard and brittle; its apparent lightness is due to its porosity. It is a bad conductor of heat; a good conductor of electricity; and is very combustible, when burnt in the air or in oxygen, giving rise to carbonic acid; has the property of absorbing a large quantity of gases or vapours into its pores, though in very different proportions; thus, of ammonia, 90 times its volume is absorbed, while of hydrogen, it takes up less than twice its own bulk.

Another very useful property of charcoal is its power of absorbing the colouring matters from organic solutions; animal charcoal is best for this purpose. Charcoal is also highly antiseptic; it is hence used for purifying water, in filtering machines; also to remove the odour from tainted flesh.—Eq.=6·12.—Symb.=C. It forms two direct compounds with oxygen, namely, carbonic oxide, and carbonic acid.

*Carbonic oxide gas*, CO.—Prepared by passing carbonic acid gas over red-hot charcoal or iron, one half of its oxygen being removed and it becoming converted into carbonic oxide; or preferably by the action of sulphuric acid or oxalic acid (an organic acid consisting of equal measures of carbonic acid and carbonic oxide), which is immediately resolved into its constituents; and on passing the gases through a strong solution of potassa, the carbonic acid is absorbed, and the carbonic oxide may be collected.

*Prop.*—Colourless and inodorous; sp. gr. 0·9927; sparingly absorbed by water; is neither acid nor alkaline; a non-supporter of combustion, but combustible, burning with a lambent blue flame, giving rise to carbonic acid; it is irrespirable. Mixed with oxygen it may be exploded by the electric spark, forming carbonic acid.

*Carbonic acid*, $CO_2$.—Discovered by Dr. Black in 1757, and named by him *fixed air;* prepared by the action of sulphuric or muriatic acid on any carbonate; the gas comes off with effervescence.

*Prop.*—Colourless; of a pungent odour and taste; very irrespirable; sp. gr. 1·524. It may be condensed into a liquid at 32° by a pressure of 36 atmospheres; this liquid may be frozen by the cold produced by its own evaporation, which is estimated at 148°. The liquefied acid is colourless, and limpid like water; the *solid* acid resembles snow. Carbonic acid acts upon animals as a poison pro-

asphyxia: it is injurious even when largely diluted with air:
the evils resulting from imperfect ventilation. It sometimes
ulates in wells and mines, constituting the choke-damp of
s. Water absorbs its own volume of this gas at any pres-
consequently the amount absorbed is determined simply by
gree of pressure to which the gas is subjected; in this way
ic acid water is manufactured. Carbonic acid exists in the
has been mentioned; also in common spring water, which
to it its pleasant flavour; the gas may be entirely driven off
ling; hence water which has been boiled is quite insipid. Its
n in water forms one of the great solvents of nature; by
of it, rocks are disintegrated and converted into soils. Its
re numerous; they are named *carbonates*, the most common
ch is *limestone*.

best test for carbonic acid is *lime-water*, to which it always
s a cloudiness, resulting from the formation of carbonate of
This may be seen also by breathing through a tube immersed
e-water.

### SULPHUR.

ound uncombined in the neighbourhood of volcanoes, as in
and Sicily; also abundantly in a state of combination with
s metals, as iron, lead, copper, antimony, &c., constituting
*rites* of mineralogists. It is procured by exposing iron pyrites
d heat, in close vessels.

*p.*—A yellow brittle solid, without odour and taste, under
ry circumstances, but acquires a peculiar odour when rubbed;
1·99; a non-conductor of heat and electricity: melts at 232°,
ch point it is a liquid of an amber colour. If the heat be
sed it begins to thicken and acquires a reddish tint; between
and 482°, it is thickest; and beyond this it again becomes
r up to its boiling point, 600°; burns when heated up to
n the open air. The *roll brimstone* of commerce, is melted
r run into cylindrical moulds. *Flowers of sulphur* are mi-
rystals of sulphur, obtained by subliming sulphur in close ves-
The sp. gr. of the vapour is 6·654. The vapour will support
stion. Crystals of sulphur may be procured by melting any
ty in an earthen vessel, and when partially cooled, breaking
ust and pouring out the liquid contents. Crystals are often
on breaking the roll brimstone of commerce.

hur is insoluble in water; soluble in the fixed and volatile
he best solvent is the bisulphuret of carbon; it dissolves in
if both substances are brought together in the state of va-
Eq. = 16. Symb. S.

uch resembles oxygen in its chemical habitudes, like that
enerating both acids and bases.

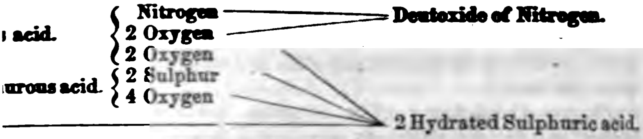
Sulphur forms six compounds with oxygen, of which the most important are sulphurous and sulphuric acids.

*Sulphurous acid*, $SO_2$—the product when sulphur is burned in the open air, or in dry oxygen;—prepared conveniently by the action of sulphuric acid on mercury or copper; a part of the acid is decomposed, yielding up sulphurous acid and oxygen; the oxygen uniting with the metal.

*Prop.*—Colourless; of a pungent, suffocating odour, and acid taste; sp. gr. 2·2105;—is condensed into a liquid at 45° by a pressure of two atmospheres, and at 0° under a pressure of one atmosphere;—a non-supporter of combustion, and a non-combustible;—cannot support respiration; water at 60° absorbs 32 times its volume. It possesses bleaching properties; its solution first reddening and then bleaching litmus. Its salts are termed *sulphites:* they are not of much importance.

*Sulphuric acid*, $SO_3$—Known in commerce as *oil of vitriol*;—may be procured in two modes: first, by exposing the protosulphate of iron (green vitriol) to a red heat, by which the sulphuric acid is driven off, and condensed, and the peroxide of iron remains. The acid thus procured is an oily brown liquid, of a sp. gr. of 1·9, fuming in the air, and very corrosive; it is known in commerce as *fuming sulphuric acid*, or *acid of Nordhausen*, from the place of its manufacture.

The second method is the one usually adopted. It depends upon the fact that when sulphurous and nitrous acid are present along with some water, the sulphurous acid takes oxygen from the nitrous acid, the first becoming sulphuric acid, and the last deutoxide of nitrogen. The mode adopted is the following: A mixture of sulphur and nitre is exposed to heat in such a manner, that the vapours are carried into a leaden chamber, upon the bottom of which is a stratum of water. The nitric acid of the nitre gives up oxygen to some of the sulphurous acid, thereby converting it into sulphuric acid, which immediately combines with the potassa; the greater part of the sulphurous acid enters the leaden chamber, when it comes in contact with deutoxide of nitrogen, atmospheric oxygen, and watery vapours, forming a white crystalline compound, believed to be composed of sulphuric acid, hyponitrous acid, and water. When this solid falls into the water on the floor of the leaden chamber, it is decomposed into sulphuric acid (which is dissolved by the water), nitrous acid and deutoxide of nitrogen. The nitrous acid thus set free, as well as that produced by the reaction of atmospheric oxygen on the deutoxide of nitrogen, is again mingled with sulphurous acid and watery vapours as before, and gives rise to the formation of another portion of the crystalline compound, which, in its turn, becomes decomposed on falling into the water. When the water in the leaden chamber es sufficiently saturated, it is drawn off and concentrated in m vessels, by heat, until it attains the sp. gr. of about 1·84. theory of the process may be expressed thus:—



D.—A dense, colourless, oily liquid, of an intensely sour taste id reaction;—consists of 40 parts, or 1 eq. anhydrous acid, parts or 1 eq. water;—extremely corrosive;—decomposes all c substances;—has a powerful attraction for water, and when with it gives rise to a great elevation in the temperature; at —15° and boils at 620°.

*ydrous* sulphuric acid may be procured by heating the Nord- acid in a retort, to which is adapted a receiver surrounded ce; a vapour passes over, which condenses into white silky s, resembling asbestos. It has such a strong affinity for water, hen put into that liquid it hisses like a hot iron; it is very e, boiling at 104°;—it does not display any acid reaction un- isture be present. *Test*, chloride of barium.

*osulphurous acid*, $S_2O_2$, cannot exist in an isolated form; it luced when sulphur is digested in a solution of sulphate of ;—a *hyposulphite* of potassa is formed.

*osulphuric acid*, $S_2O_5$, is procured in solution by suspending le of manganese in water artificially cooled, and then trans- g through it a stream of sulphurous acid gas; the *hyposulphate* protoxide of manganese is thus formed, which is decomposed yta, and the barytic salt in its turn decomposed by sulphuric

other acids of sulphur have recently been discovered, called ively the *sulphuretted hyposulphuric acid*, $S_3O_5$, and *bisul- ed hyposulphuric acid*, $S_4O_5$.

## SELENIUM.

ry rare substance, much resembling sulphur in its chemical les. It is a reddish brown solid body, having an imperfect c lustre, and a sp. gr. of 4·3;—melts at about 212° and boils . It forms an oxide and two acids.

## PHOSPHORUS.

ts in bones and urine;—prepared from bones, in which it s phosphate of lime, by calcining, and then adding sulphuric l water; the sulphate of lime is precipitated, and the phosphoric acid left in solution with some of the lime, as a superphosphate. This is evaporated, mixed with charcoal and exposed to a high heat; the phosphorus distils over into water.

*Prop.*—When pure it much resembles wax, being soft and flexible, and of a flesh colour; sp. gr. 1·77;—fuses at 108°;—boils at 550°;—insoluble in water, but dissolves in naphtha and oils;—very inflammable;—burns with a bright flame generating phosphoric acid. It undergoes a slow combustion in the open air, giving a luminous appearance in the dark; this combustion may, however, be entirely prevented by the presence of olefiant gas, vapour of ether, or an essential oil. Eq.=15·7, or (according to some) 31·4. Symb. P.

Phosphorus forms four compounds with oxygen.

*Oxide of phosphorus*, $P_3O$, or $P_2O$, formed by melting phosphorus under hot water, and bringing a stream of oxygen gas in contact with it:—it has a red colour;—is insoluble in water, alcohol, or ether.

*Hypophosphorous acid*, $P_2O$, or $PO$;—is formed when phosphuret of barium is put into water; it is a powerful deoxidizing agent.

*Phosphorous acid*, $P_2O_3$, or $PO_3$; formed by burning phosphorus in a limited supply of oxygen or air; in this state it is anhydrous, and is in the form of a white powder, very deliquescent. It forms *phosphites*, which are of little importance.

*Phosphoric acid*, $P_2O_5$, or $PO_5$;—prepared by burning phosphorus in the open air or in oxygen, by which it is procured in the anhydrous form; also by heating phosphorus in nitric acid; also from bones, by acting on the phosphate of lime (which is formed as already described) by carbonate of ammonia, then evaporating the phosphate of ammonia, and heating in a platina crucible.

*Prop.*—Very deliquescent; is a powerful acid; very sour, but does not corrode like nitric and sulphuric acids. It is capable of existing in three different states or modifications, forming three separate classes of salts, which differ completely in properties and constitution. They are distinguished by the names *tribasic*, *bibasic*, and *monobasic* acids, according to the number of equivalents of base required to form neutral salts.

The *tribasic phosphoric acid* is the acid of the well-known phosphates; it is characterized by yielding with a soluble salt of silver, a yellow insoluble phosphate. It contains 3 eq. water.

The *bibasic phosphoric acid*, also called the *pyrophosphoric acid*, is procured by heating the former acid at a temperature of 415°;—it is distinguished from the tribasic acid by yielding a *white* instead of a yellow precipitate with the salts of silver. It contains 2 eq. of water.

The *monobasic phosphoric acid*, also named *paraphosphoric acid*, is procured when phosphorus is heated in the open air, and also when a concentrated solution of the tribasic or bibasic acids is heated

ss. By the former method, it is anhydrous; by the latter
ydrate. The hydrate is very fusible, and on cooling it con-
nto a transparent brittle solid, called *glacial phosphoric acid*,
s very deliquescent. It contains 1 eq. of basic water. It
n insoluble compound with albumen.

## BORON.

e basis of boracic acid;—may be procured from boracic acid
ing it with potassium; the oxygen of the acid, uniting with
assium, sets the boron free.
.—A dark olive-coloured substance; insoluble; a non-con-
of electricity; when burned in the open air or oxygen, it
es boracic acid. Eq.=10. Symb. B. It forms only one
nd with oxygen, namely, *boracic* or *boric acid*. This can
ured by decomposing biborate of soda (borax) by means of
ic acid; the sulphate of soda remains in solution, and the
acid is deposited in the form of crystals.
sparingly soluble in cold water, more so in hot water, and
luble in boiling alcohol. The alcoholic solution when set on
ns with a beautiful green flame,—a good test of its presence.
boracic acid is heated, it melts into a glassy mass.
most important salt of boracic acid is *borax*—a biborate of

## SILICON.

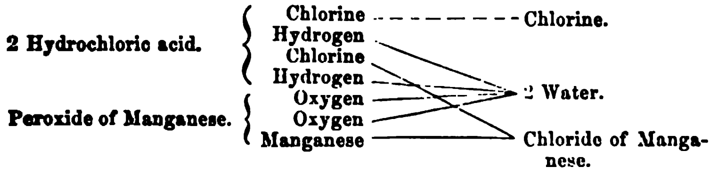
basis of silex or silicic acid;—procured by heating the double
of silicon and potassium; the latter combines with the fluo-
berating the silicon.
.—A dark brown powder, a non-conductor of electricity, and
the metallic lustre; heated in the air, it burns and is con-
into silicic acid;—forms only one compound with oxygen.
2·18. Symb. Si.
*ic acid*, $SiO_3$,—known also as silex or siliceous earth—exists
ntly in nature in the form of quartz and sand. Rock crystal
y pure form of it.—Prepared by igniting transparent rock
, throwing it when red hot into water, and then reducing to
; or by heating together powdered quartz or sand, and car-
of soda: a silicate of soda is formed, which is to be boiled in
hydrochloric acid is then added, which combines with the
recipitating the silicic acid in the form of a gelatinous mass.
.—A white powder, insoluble, tasteless; sp. gr. 2·69; very
le; has no action on test paper on account of its insolubility;
s a powerful acid, since it forms salts with the alkalies. Com-
ass is a silicate of potash. The best varieties of glass are
ure alkali and very fine sand, free from iron: flint-glass
ome litharge or red lead. If the proportion be re-

versed, so as to have one part of silicic acid with three of potash, we have a soluble silicate of potash, called *liquor silicum*, or *liquor of flints.*

## CHLORINE.

Chlorine, along with Iodine, Bromine, and Fluorine, forms a group of simple bodies whose chemical habitudes are remarkably similar. They, together with Cyanogen (a compound body), are termed *halogen bodies*, because they form salts resembling sea-salt, or chloride of sodium.

Chlorine exists abundantly in nature as an ingredient in common salt. It was discovered, in 1774, by Scheele, and by him called *dephlogisticated marine acid.* The French chemists named it *oxymuriatic acid*, from an opinion that it consisted of muriatic acid and oxygen. In 1809, Davy discovered its true nature, and gave to it the name of *chlorine*, from a Greek word signifying greenish-yellow. Prepared by the action of hydrochloric acid on peroxide of manganese, with the aid of heat; chlorine is set free, and water and a chloride of manganese are formed, thus:



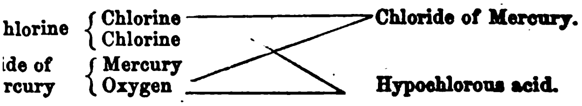
*Prop.*—A yellowish-green gas, irrespirable, exciting strong spasms of the glottis;—sp. gr. 2·47; water at 60° absorbs twice its volume. It is best collected by conducting it, by means of a tube, into the bottom of tall receivers, the air being thereby displaced. The watery solution, on being exposed to the light, is slowly changed into chloro-hydric acid, oxygen being set free. When moist chlorine is exposed to a cold of 32°, yellow crystals are formed, being a compound of chlorine and water. Chlorine is condensed into a liquid by a pressure of four atmospheres. It is a non-combustible, but a supporter of combustion; a lighted taper burns in it for a short time, but several of the metals, as antimony, tin, copper, and arsenic, take fire spontaneously when presented to it in a finely-divided state. In these cases, a *chloride* of the metal is formed. The strongest affinity of chlorine is for hydrogen: it is in consequence of this that it acts so powerfully as a *bleaching* agent, water being always decomposed in the process, the hydrogen uniting with the chlorine to form chlorohydric acid, and the oxygen which is set free being the real decolorizing agent.

Chlorine is also useful as a *disinfecting* agent. The best test for e is a soluble salt of silver;—a white insoluble chloride of s formed.

non-acid compounds of chlorine are called *chlorides*. Eq.=36. Cl.

rine forms *four* compounds with oxygen; none of them are rmanent, but they are all easily decomposed.

*chlorous acid*, ClO, or protoxide of chlorine, is obtained by ion of chlorine gas on peroxide of mercury, thus:—



a pale yellowish gas,—possesses powerful bleaching proper- d forms bleaching salts.

*rous acid*, $ClO_4$, peroxide of chlorine;—prepared by heating a e of sulphuric acid and chlorate of potassa; the chloric acid is set free is spontaneously decomposed into chlorous acid pochloric acid, the latter remaining in union with the potassa. a richer colour than chlorine, and is very explosive.

*ric acid*, $ClO_5$, the most important compound of the series; ared by adding sulphuric acid to the chlorate of baryta. If e gas be transmitted through a solution of caustic potassa, a e of potassa crystallizes, and the chloride of potassium re- n solution. The chlorates are easily recognised;—they give re oxygen when heated, passing into chlorides; they yield s acid on being heated with sulphuric acid; but give no pre- e with silver.

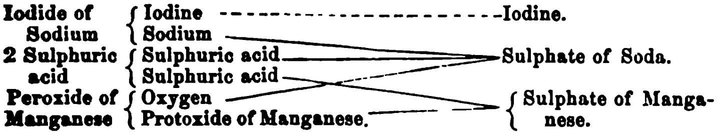
*hloric acid*, $ClO_7$, prepared by acting on the perchlorate of with sulphuric acid. It has a very strong affinity for e;—forms salts resembling the chlorates.

*ride of nitrogen*, $ClN_4$, prepared by transmitting chlorine ough a solution of muriate of ammonia; globules of an oily are formed, which subside to the bottom;—it is the most ve substance known.

rine also forms compounds with carbon, carbonic acid, phos- boron, and silicon. The important compound of chlorine drogen will be described subsequently.

## IODINE.

ts in sea-weeds, and in certain saline springs;—usually pre- rom *kelp*, an impure carbonate of soda; the mother waters contain iodine in combination with sodium, or potassium. his the iodine may be evolved by the action of sulphuric acid oxide of manganese; the rationale is as follows:—



*Prop.*—A solid of a bluish-black colour, and metallic lustre; in crystalline scales;—sp. gr. 49; fuses at 225°; boils at 347°; colour of vapour a rich violet; slowly volatile at common temperatures, exhaling an odour resembling that of chlorine; density of vapour 8·716, being the heaviest of all vapours; very sparingly soluble in water, but soluble in alcohol. The best *test* for iodine is starch, with which it forms a blue compound.

The affinities of iodine are not so strong as those of chlorine, since the latter always displaces iodine from its compounds.

The non-acid compounds of iodine are called *iodides.*—Eq.=126. Symb. I.

Iodine forms at least two compounds with oxygen.

*Iodic acid,* $IO_5$, forms iodates.

*Periodic acid,* $IO_7$.

Iodine forms a compound with chlorine, the *chloride of iodine;*—also with nitrogen, a very explosive compound, similar to the chloride of nitrogen;—also with phosphorus and sulphur.

### BROMINE.

Is found in sea-water as a bromide of magnesium; also in certain saline springs;—procured from bromide of potassium by sulphuric acid and peroxide of manganese: the reaction is precisely similar to that in the case of iodine.

*Prop.*—A very volatile liquid, of a deep reddish-brown colour; freezes a little below 0°; boils at 116°; odour very suffocating and offensive; slightly soluble in water; more so in alcohol and ether. The aqueous solution bleaches. It is very poisonous; its chemical habitudes are closely allied to those of chlorine and iodine; it forms compounds with oxygen, chlorine, iodine, hydrogen, sulphur, phosphorus, carbon, and silicon.—Eq.=78·4. Symb. Br.

### FLUORINE.

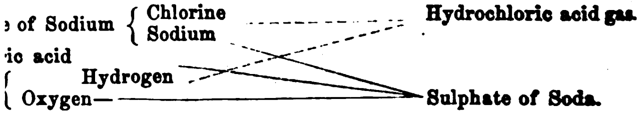
Occurs in nature in combination with calcium, in the well-known *fluor spar;* has only lately been isolated, on account of its energetic affinities. It is a yellowish gas, with an odour resembling chlorine;—has a powerful affinity for hydrogen and the metals;—sp. gr. 1·289;—Eq.=18·68. Symb. Fl. Its compounds with hydrogen, silicon, and boron will be described in the subsequent section.

## SECTION II.

### UNDS OF SOME OF THE FOREGOING SIMPLE SUBSTANCES WITH EACH OTHER.

### COMPOUNDS OF HYDROGEN.

*rine and Hydrogen;—Hydrochloric acid, Chlorohydric acid, iatic acid,* HCl;—prepared by the action of dilute sulphuric chloride of sodium, according to the following rationale:



.—A colourless gas; gives off dense fumes on exposure to ; has a very powerful affinity for water, and hence must be d over mercury; condensed into a liquid by a pressure of 40 heres; sp. gr. 1·269; water absorbs 418 times its bulk.

solution of this gas in water constitutes the *muriatic acid* of rce. This, when pure, is colourless; but usually has a light olour—due to impurities, as iron, nitric and sulphuric acids, Vhen mixed with nitric acid it forms *aqua regia,* which has operty of dissolving gold, in consequence of the chlorine l; water and nitrous acid are also formed at the same time. is essential to develope the acid properties of this acid. speaking, it is a *chloride of hydrogen;* and when added to l, its hydrogen is simply displaced by the latter.

*rogen and Iodine.—Hydriodic acid,* HI.—A gas much reg hydrochloric acid;—prepared by heating water in union dide of phosphorus; the hydrogen combines with the iodine, hydriodic acid, and the oxygen with the phosphorus, to form oric acid.

.—Colourless; acid; has a strong affinity for moisture, and ut white fumes in the air. It is decomposed by chlorine, e formation of hydrochloric acid, and evolution of iodine; ic and nitric acid also decompose it by imparting oxygen, e evolving iodine.

*rogen and Bromine.—Hydrobromic acid,* HBr;—prepared driodic acid, from a bromide of phosphorus.

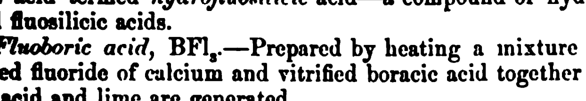
.—A colourless gas, irrespirable, acid; is decomposed by e, but not by iodine.

*rogen and Fluorine.—Hydrofluoric acid,* HFl;—prepared action of dilute sulphuric acid on fluoride of calcium (fluor spar); the chemical changes are analogous to those occurring in the preparation of hydrochloric acid.

*Prop.*—At 32° it is a colourless liquid, but when exposed to the air, it flies off in dense white fumes; sp. gr. 1·0609;—its affinity for water surpasses even that of sulphuric acid, the combination being accompanied with a hissing noise; its vapour is extremely pungent; it is very destructive to organized bodies, as the skin, upon which it produces a deep and painful ulcer. It acts powerfully on glass, forming with it fluosilicic acid; on this account it must be prepared in metallic vessels. From its affinity for glass, it may be used for etching on that substance; the glass being coated with a thin film of wax and the figures traced with a pointed instrument; it is then submitted to the action of the gas, which, acting only on the exposed portions of the glass, leaves an indelible mark upon them.

Under this head it will be convenient to allude to some other compounds of fluorine.

*Fluosilicic acid*, or *Fluoride of Silicon*, SiFl,—is formed whenever hydrofluoric acid comes in contact with glass; it is best made by heating a mixture of powdered fluor spar and glass with strong sulphuric acid; the changes are as follows:—the hydrofluoric acid (generated by the action of the sulphuric acid on fluoride of calcium) reacts with the silicic acid of the glass so as to form water and fluosilicic acid, thus:

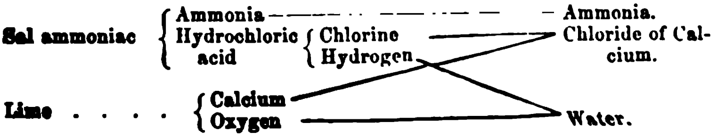


*Prop.*—A colourless, irritating gas, producing white fumes on escape into the air, from the action of moisture; is decomposed by water into pure silicic acid, which is deposited in flakes, and into a new acid termed *hydrofluosilicic* acid—a compound of hydrofluoric and fluosilicic acids.

*Fluoboric acid*, $BFl_3$.—Prepared by heating a mixture of powdered fluoride of calcium and vitrified boracic acid together; fluoboric acid and lime are generated.

*Prop.*—A colourless, pungent gas; decomposed by water into boracic acid and *borohydrofluoric* acid.

*Hydrogen and Nitrogen.*—*Ammonia*, or *volatile alkali*, $NH_3$. Prepared by heating a mixture of powdered sal ammoniac and quick lime; by a double decomposition we have gaseous ammonia, chloride of calcium, and water, thus:



.—A colourless gas, of a strong and pungent odour; very absorbed by water (more than 700 times its own volume); ·589; has a powerful alkaline reaction; is condensed into a ındér a pressure of 6·5 atmospheres at 60°; cannot be formed lly by a direct union of its elements, but is an abundant pro- the putrefaction of animal substances; it may be decomposed electric spark, by chlorine, and by being passed through a porcelain tube.

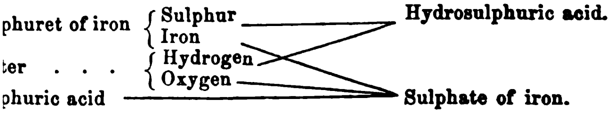
solution of ammonia (*aqua ammoniæ*) may be prepared by saturating water with gaseous ammonia; it is colourless, and ɜs the pungent odour and alkaline reaction of the gas.

ıonia forms salts with the different acids, which are all de- ed by a red heat, and by a less powerful heat, if they are vith an alkali or alkaline earth. The ammoniacal salts were y considered to be formed by a direct union of the alkali and l; but, at present, the acid is believed to unite with the oxide ypothetical metal termed *ammonium*. This supposed metal ver been isolated, but is inferred to exist from the fact that mmonia is decomposed by a galvanic current, and the nega- re terminates in some mercury, an amalgam is formed, hav- the characters of an ordinary metallic amalgam; but when itself, this amalgam rapidly decomposes into mercury, hy- and nitrogen. Ammonium is believed to be composed of ia and one eq. of hydrogen; it is represented by $NH_4$, and c of the ammoniacal salts would consequently be represented $_4$O.

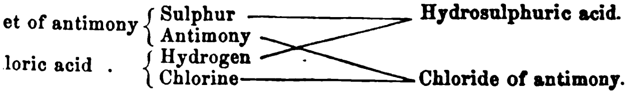
most important of these salts are the *chloride of ammonium*, moniac), the *carbonates*, the *nitrate*, and the *sulphate*.

e is believed to be yet another compound of hydrogen and n, to which the name of *amide*, or *amidogen*, is given. Like ium, it has never been isolated: it is represented by $NH_2$.

*rogen and Sulphur.—Sulphuretted hydrogen, Hydrosulphuric* S.—Conveniently prepared by the action of dilute sulphuric sulphuret of iron; or by chlorohydric acid on sulphate of ıy, as follows:—



or



.—A colourless gas, having the odour of rotten eggs; irrespirable, acting as a narcotic; combustible, burning with a blue flame, producing water and sulphurous acid; a non-supporter of combustion; becomes a liquid under a pressure of 17 atmospheres; is decomposed by chlorine, with a deposition of sulphur; sp. gr. 1·171; it has the properties of a weak acid, reddening litmus paper, and forming salts.

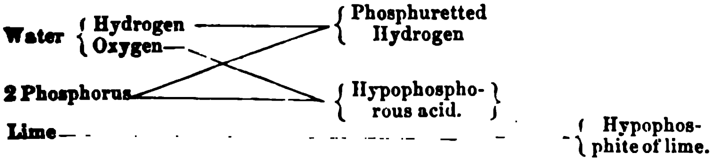
The best *test* is acetate of lead, with which it forms the black sulphuret of lead.

Hydrosulphuric acid is valuable to the chemist as a test for metallic solutions, causing with them an insoluble precipitate of the sulphuret of the metal.

There is another compound of sulphur and hydrogen, called *persulphuret of hydrogen.*

*Hydrogen and Selenium.—Hydroselenic acid,* HSe;—in its general properties it resembles hydrosulphuric acid.

*Hydrogen and Phosphorus.—Phosphuretted hydrogen,* $PH_3$, prepared by boiling together hydrate of lime, water, and phosphorus; the water is decomposed, and hypophosphite of lime and phosphuretted hydrogen are formed, thus:—



The most remarkable feature of this gas is its spontaneous inflammability; so that if the beak of the retort in which it is evolved be placed under water, as each bubble of gas rises through the liquid it takes fire, and forms a beautiful ring of a dense white smoke, which enlarges as it ascends.

## COMPOUNDS OF CARBON AND HYDROGEN.

The number of these compounds has now become very great; but most of them belong properly to the domain of organic chemistry; two of them, however, are generally considered under the head of inorganic chemistry: these are Light carburetted hydrogen and Olefiant gas.

*Light carburetted hydrogen, marsh gas, fire-damp, dicarburet of hydrogen,* $CH_2$;—is formed in stagnant pools by the decomposition of vegetable matters; and may be procured by stirring up the mud at the bottom of the pool, and collecting the gas. It may be prepared by strongly heating a mixture of acetate of soda, hydrate of potash and quicklime: the gas is derived from the decomposition of the acetic acid and water.

19.

*Prop.*—Colourless, tasteless, nearly inodorous; a non-supporter of combustion or respiration, but very combustible, burning with a bright yellow flame;—mixed with oxygen in due proportions, it forms an explosive mixture; products of its explosion or combustion, water and carbonic acid; sp. gr. ·559. This gas is frequently evolved in large quantities from coal mines, and explodes on contact with the flame of the miner's lamp, causing the most disastrous consequences. Sir H. Davy's *safety-lamp* was invented to obviate these fatal results. It consists of a common oil-lamp, enclosed in a cage of wire-gauze, made double at the upper part, containing about 400 apertures to the square inch. When this lamp is taken into an explosive mixture, although the fire-damp, passing inside the gauze, may burn within the cage with such energy as to heat the metallic tissue to redness, the flame is not communicated to the mixture on the outside, in consequence of the cooling effect produced upon the heated gas by the wire-gauze; most fortunately, the fire-damp has a
igh kindling point; it will not inflame at the red heat of
ıuze.

ɔrine does not act on light carburetted hydrogen, if kept in
rk; but if the light be admitted, a combination ensues,
ɜd with the formation of hydrochloric and carbonic acids.

*iant gas*, $C_2H_2$;—so called from its property of forming an
liquid with chlorine. Prepared by heating a mixture of
sulphuric acid and alcohol; at first ether is formed, and
over along with vapour of alcohol; afterwards the olefiant gas
over along with sulphurous and carbonic acid; the two latter
be absorbed by potassa.

ɔ.—Colourless, tasteless and inodorous; water absorbs about
hth of its volume; a non-supporter of combustion and respi-
but burns with a dense bright light, producing carbonic acid
ter; mixed with a due proportion of oxygen, it explodes by
of the electric spark; sp. gr. ·981; mixed with chlorine, it
ıes with it in equal measures, forming a heavy, oily liquid, of
h taste and ethereal odour, termed *Dutch liquid*.

*ne* is gas heated to a white heat. It owes its *light* to the
e of solid particles of carbon, there not being sufficient oxy-
consume them. Hydrogen yields an intensely hot flame,
its but a feeble light, because it contains no solid matter.
gas employed for illuminating purposes is usually made from

coal, oil, resin, and other organic substances containing a large quantity of carbon and hydrogen. The coal is distilled in cast iron retorts, maintained at a bright red heat; and the volatilized products conducted through long pipes into receptacles where it is purified by means of hydrate of lime. Coal gas contains a number of different principles, as light carburetted hydrogen, olefiant gas, hydrogen, carbonic oxide, nitrogen, and some other volatile substances. Besides these, a number of other matters are separated in the processes of condensation and purification, as tar, sulphuretted hydrogen, sulphate of ammonia, &c. The relative illuminating power of different varieties of coal and oil gas depends upon the relative amount of carbon and hydrogen contained; the light being greatest when these are in excess, provided always, there be enough oxygen to burn them completely.

### COMPOUNDS OF NITROGEN AND CARBON.

*Cyanogen, Bicarburet of nitrogen*, $NC_2$ or Cy. Prepared by heating in a retort the bicyanide of mercury; the cyanogen passes off in the form of a gas, and the mercury sublimes.

*Prop.*—Colourless, of a strong and peculiar odour; condenses into a liquid at 45° under a pressure of 3·6 atmospheres; a non-supporter of combustion, but inflammable, burning with a characteristic purple flame, producing water and carbonic acid. Water absorbs four or five times its volume, and alcohol much more;—sp. gr. 1·806.

*Paracyanogen* is the name given to the black matter left in the retort after the preparation of cyanogen.

*Tests.*—The peculiar odour; the *white* precipitate formed with silver; the blue compound obtained by heating it with an alkali and a persalt of iron.

*Cyanogen and Hydrogen.*—*Hydrocyanic acid, Cyanhydric acid, Prussic acid*, CyH. Prepared in the anhydrous form, by passing sulphuretted hydrogen over fragments of bicyanide of mercury, contained in a horizontal glass tube, and receiving the product in a vessel surrounded with a freezing mixture. Gentle heat is applied to the tube, and the cyanogen reacting with the sulphuretted hydrogen, produces hydrocyanic acid and the sulphuret of mercury.

*Prop.*—A thin, colourless liquid, exceedingly volatile; sp. gr. ·7058; boils at 79° and freezes at 0°; has a powerful characteristic odour of peach blossoms or oil of bitter almonds; has a very feeble acid reaction; unites with water and alcohol in all proportions. In its anhydrous state it is one of the most poisonous substances known. The best antidotes are chlorine and ammonia. It is very liable to decomposition, especially if exposed to the light.

The *solution* of hydrocyanic acid is best prepared by the action

te sulphuric acid on the ferrocyanide of potassium. Also by
ion of hydrochloric acid on the cyanide of silver.
rocyanic acid is an organic product, being frequently met
the vegetable kingdom. It is believed, however, not to pre-
n vegetables, but to be due to the mutual reaction of two or-
rinciples, named *amygdaline* and *emulsine* or *synaptase*, with

*nic Acid*, CyO,—may be prepared from cyanate of potassa.
o.—A limpid, colourless liquid, with a pungent odour. With
ia it forms a compound isomeric with *urea*.
*minic Acid*, $Cy_2O_2$, is developed by the action of hyponitrous
alcohol in the presence of either silver or mercury. These
*ates* are violently explosive.

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# CHAPTER II.

## SECTION I.

## METALS.

### GENERAL PROPERTIES.

Y are all conductors of heat and electricity; they are positive
s; they are opaque; possess generally a well-marked lustre,
*metallic;* and are generally good reflectors of light. The
r generally admitted by chemists is forty-nine. Some of them
very rare occurrence. They vary greatly in specific gravity,
een potassium, which is lighter than water, and platinum,
is twenty-one times heavier.
*erties which are peculiar to certain metals.*—*Malleability*,
*y*, *tenacity*, the *welding process*, *hardness*, and the *crystalline*
*re.*
are solid at common temperatures, except mercury. Their
point varies very much—ranging between mercury, which is
and platinum, which is infusible at the heat of a smith's

ls often unite together to form *alloys*. When mercury unites
other metal, the compound is named an *amalgam*. Exam-
alloys are *brass*, from copper and zinc; *bronze*, from copper
; *bell-metal*, from copper and tin; *type-metal*, from anti-
nd lead; *solder*, from tin and lead. Gold and silver coins
alloys. Many of the alloys occur native.
few of the metals are found native, that is, in their uncom-
orm. They usually are united with either oxygen or sulphur,
they occur as salts.

Metals differ greatly in their attraction for oxygen; some have such a powerful affinity for this agent, that they decompose water, in order to unite with it. On the other hand, gold, silver, and platinum are very difficult to oxidize. The term *noble* has been given to such metals as are not liable to tarnish on exposure to the air.

Most metals may be oxidized by exposure to heat in the open air. This process was formerly termed *calcination;* and the product formed a *calx.* Another mode of oxidizing is by *deflagration,* or by heating with nitrate of potassa, or chlorate of potassa. Nitric and nitro-hydrochloric acids are also powerful oxidizing agents.

Metallic oxides may be *reduced* either by heat alone, as in the case of the oxides of the noble metals, or by the united agency of heat and combustible matter, as hydrogen, charcoal, and the *black flux;* or by galvanism, which is still more powerful; or by the agency of deoxidizing agents, as phosphorous acid, protochloride of tin, &c.; or by precipitation from their solutions by means of other metals: thus silver is thrown down from a solution of its nitrate by means of mercury; copper, by means of iron, and so on.

The compounds of metals with oxygen, are for the most part *oxides;* occasionally they are *acids.* Arsenic is the only one which forms an acid, without, at the same time, forming an oxide. Most of the metallic oxides act as *salifiable bases*—that is, they form salts with acids. Generally, but not always, this property is confined to the *protoxides.*

Chlorine, bromine, iodine, and fluorine have also a strong affinity for metals,—particularly the two former.

Sulphur has a strong tendency to unite with metals: the combination may be effected either by heating the powdered metal and sulphur together; by igniting together a metallic oxide and sulphur; by heating a sulphate, along with combustible matter, by means of which the oxygen is removed in the form of carbonic acid; or by the action of hydrosulphuric acid. Several of the metallic sulphurets (sulphides) occur native, as of lead, antimony, iron, zinc, &c.

The compounds of selenium and the metals closely resemble the sulphurets.

Phosphorus and hydrogen occasionally unite with the metals.

Before describing metals individually, it may be proper to bestow a few remarks on the subjects of *Salts* and *Crystallization.*

## SECTION II.

### SALTS.

The term *salt* was formerly restricted to a compound of an acid and a salifiable base; but this definition was necessarily va t of the difficulty of always accurately defining what was an d what was a base. Formerly, an acid was considered to be lized body which has a sour taste, reddens litmus, and neu- alkalies. Subsequent discovery showed the propriety of ng this definition; for, first, the discovery of the hydracids that oxygen is not essential to acidity; and secondly, some nds, owing to their insolubility, have neither a sour taste, they redden litmus, yet they neutralize bases; thirdly, there e acknowledged acids, as carbonic, hydrocyanic, &c., which ble fully to destroy the alkalinity of potassa.

nists of the present day agree to call all such bodies *acid* nite with potassa or ammonia, and give rise to bodies similar titution and general character to the salts which sulphuric or ther admitted acid forms. For similar reasons, the present of what constitutes an alkaline or salifiable base, is that of a hich unites definitely with admitted acids, to form with them nds resembling recognised salts.

e is a very important class of compounds, which, however, not fall within the range of the above definition of a salt; ich yet have undoubted claims to be considered as such: mprise the chlorides, iodides, bromides, &c., and are named salts, from a Greek word signifying *sea salt.*

notion of a salt has been still farther extended. It is known vo metallic sulphurets occasionally unite together to form a nd called a *double sulphuret.* To such compounds Berzelius he name of *sulphur-salts.* They are precisely analogous in omposition to a common oxy-salt, as may be seen by simply uting for the sulphur an equivalent quantity of oxygen. In salts, the *sulphur-acid* is a sulphuret of some one of the negative metals, as arsenic, antimony, tungsten, &c.; the *-base* is a sulphuret of an electro-positive metal, as potas- odium, mercury, &c.

s also been found that the haloid salts will unite together, to hat is termed a *double haloid salt;* which also may be con- precisely analogous to an oxy-salt, the halogen element ne, iodine, &c.), simply taking the place of oxygen.

we may make two generic divisions of salts into 1, *am- salts,* or those which are formed from amphigen bodies (oxy- lphur, selenium, and tellurium), and 2, *halogen salts,* or ontaining a halogen body (chlorine, iodine, bromine, fluorine, nogen).

*double salt* is meant one in which the same acid is united o separate bases, as tartar emetic (tartrate of oxide of anti- nd potassa).

ly all salts are solid at common temperatures; most are of crystallizing; their colour is variable; the soluble ones are more or less sapid; very few are odorous. They differ much in their affinity for water: some attract moisture from the air and become liquid; such salts are called *deliquescent*. They differ also very much in their solubility in water, which is in the direct ratio of their affinity for water, and in the inverse ratio of their cohesion. In many salts water acts as a base, and is hence termed *basic water*.

As a general rule, every salt has its own distinct *crystalline form*, by which it may be recognised. Crystallization may be effected in various ways, as by solution and evaporation: the slower the evaporation, the larger and more regular the crystals; if the evaporation be made very rapid by heat, a confused crystalline mass is obtained. Fusion and slow cooling may sometimes be employed; thus crystals of sulphur and bismuth may be procured. A third condition under which crystals form, is in passing from the gaseous to the solid state, as in the case of iodine.

Many salts, in crystallizing, unite chemically with a definite portion of water, which belongs to the crystal, but not to the salt; this is termed *water of crystallization*. By a strong heat, all this water is expelled, and the salt is said to undergo the *watery fusion*. Such salts, when exposed to the air, are liable to part with a portion of this water, and crumble down into a powder; they are said then to be *efflorescent*. Others contain water even more intimately connected with them, and termed *constitutional water*.

Some salts, again, in crystallizing, enclose a portion of water mechanically within their texture; which, by its expansion, when the salt is heated, causes it to burst with a crackling noise; this is termed *decrepitation*.

Atmospheric pressure exerts an influence on the crystallization of salts; if, for instance, a hot saturated solution of sulphate of soda be corked up in a bottle while the latter is full of vapour, the solution will cool down to the temperature of the air without crystallizing; but on admitting the air, crystallization commonly commences, and the whole becomes solid in a few seconds.

Crystals are of various forms: they are divided by crystallographers into *simple* and *compound*. By *cleavage* is meant that property of a crystal by which it admits of being split in certain directions.

Bodies are said to be *isomorphous* when they have the same crystalline structure, but a different chemical composition: thus arseniate of soda is isomorphous with phosphate of soda. On the other hand, the same substance may have, under different circumstances, two crystalline forms; in which case it is said to be *dimorphous*: sulphur and carbon are examples. The instrument employed to ascertain the angles of crystals is termed a *goniometer*.

## SECTION III.

### OXYSALTS.

class of salts includes those, of which both the acid and base
les. It will be convenient to classify them according to their
t acids.

#### SULPHATES.

r solutions may always be recognised by yielding a white
tate (sulphate of baryta), with a solution of a salt of baryta.
in contact with charcoal or hydrogen they are converted into
rets, which, if moistened, yield the peculiar odour of sulphu-
hydrogen. They are almost all insoluble in alcohol. The
es of baryta, tin, antimony, lead and bismuth, are quite inso-
n water. Those of lime, strontia, mercury, silver, and a few
are nearly insoluble; while all the other sulphates are so-

most important sulphates are those of potassa, soda, magne-
ia, baryta, iron, copper, zinc, and mercury.
most important *double sulphates* are the different *alums.*
n alum is a double sulphate of alumina and potassa. It may
ared from native *alum stone,* in which the materials exist
ormed, or from a direct union of its constituents.
e are other varieties of alum, in which the sulphate of potassa
ced by sulphate of soda, or sulphate of ammonia;—also *iron*
*nganese* alums, in which the sulphate of alumina is replaced
ively by the sulphate of iron and the sulphate of manga-

*Sulphites, Hyposulphites,* and *Hyposulphates,* are of very
ractical importance.

#### NITRATES.

e may be prepared by the action of nitric acid on metals,
ne salifiable bases,—or on the carbonates. As they are soluble
heir acid cannot be precipitated by any reagent. They are
uished by deflagrating with charcoal, and other combustibles.
exposed to a high temperature, they are decomposed with the
on of oxygen gas. If subjected to the action of sulphuric
ey give off nitric acid fumes. When added to hydrochloric
ey form a solvent for gold leaf, by liberating the chlorine.
most important nitrates are those of potassa, soda, ammonia,
mercury, and silver.
*Nitrites* are comparatively unimportant.

### CHLORATES.

These are very analogous to the nitrates. They are all decomposed by a red heat into metallic chlorides and oxygen gas. They deflagrate with combustibles even more violently than the nitrates. They are nearly all soluble in water.

The most important salt of this class is the *chlorate of potassa*, which is useful to the chemist in the preparation of oxygen.

The *Chlorites* are chiefly remarkable for their bleaching and oxidizing properties.

The *Hypochlorites* may be produced by the action of chlorine gas upon salifiable bases. The most important of them is the *hypochlorite of lime*, the well-known bleaching-powder, commonly called chloride of lime. It is prepared by exposing thin strata of recently-slaked lime to an atmosphere of chlorine: the chloride of calcium and hypochlorite of lime are formed.

### IODATES.

These are compounds of iodic acid and a base. They bear a general resemblance to the chlorates, and may be recognised by the facility with which they are decomposed by deoxidizing agents, as hydrochloric, sulphurous, and phosphorous acids, which unite with the oxygen, setting iodine free.

The *Bromates* generally resemble the iodates.

### PHOSPHATES.

As regards this class of salts, it is to be remembered that there are three isomeric phosphoric acids, termed *tribasic*, *bibasic*, and *monobasic*, or *phosphoric*, *pyrophosphoric*, and *metaphosphoric* acids. Each one of these modifications forms its own peculiar salts, the tests for which were spoken of under the head of Phosphorus. The most important phosphates are those of soda, lime, ammonia, lead, and silver.

### CARBONATES.

These are distinguished by their facility of decomposition by any of the acids, with effervescence. All the alkaline carbonates are decomposable by heat, except those of potassa, soda, baryta, strontia, and probably lithia. All except those of potassa, soda, and ammonia, are sparingly soluble in water; but are more or less soluble in an excess of carbonic acids. Several of the carbonates occur native, as those of lime, magnesia, soda, baryta, iron, copper, and lead.

The most important carbonates are those of potassa, soda, lime, ammonia, magnesia, baryta, iron, copper, and lead.

### ARSENITES AND ARSENIATES.

These are salts of arsenious and arsenic acids respectively. The s are all decomposed by a red heat, the arsenious acid being lissipated in the form of vapour, or converted into arsenic

*arseniates* are not so easily decomposed, requiring usually rith heat the aid of charcoal, or black flux.

### CHROMATES.

salts of chromic acid are mostly of a yellow or red colour, the int predominating whenever the acid is in excess. They are e as pigments. The most important of the chromates are f potassa and lead.

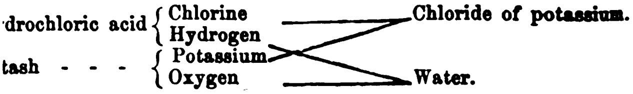
### BORATES.

salts of boracic acid are very easily decomposed. The most ant one is the *biborate of soda*, or common borax. They may recognised by their solutions in strong alcohol, burning with iish flame.

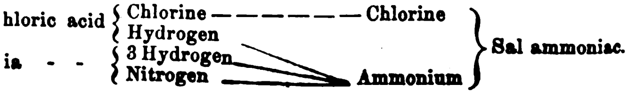
## SECTION IV.

### HYDROSALTS.

this term is understood such salts, of which either the acid or ntains hydrogen. Formerly, this class of salts was much more ive than it is at present, in consequence of the different views of the composition of the so-called *muriates*, or *hydrochlorates*, iich are now generally spoken of as chlorides. Indeed, all the salts are now considered as compounds of the halogen element ne, iodine, bromine, &c.) with a metal, rather than as com- of a hydracid with the oxide of the metal, which was the view. According to the present doctrine, when a hydracid ented to any salifiable base, both are decomposed, water and a salt of the metal being formed. Take hydrochloric acid and by way of example.



only hydro-salts which are now at all recognised are the com- of ammonia with a hydracid; though even these might be ered as haloid salts of the hypothetical metal *ammonium*. ill be evident by the following diagram:—



The most important of the ammoniacal salts are the *hydrochlorate*, commonly called sal ammoniac, and the *hydrosulphate*, formerly termed the *fuming liquor of Boyle*.

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## SECTION V.

### SULPHUR SALTS.

THE sulphur salts are double sulphurets, just as the oxy-salts are double oxides; the sulphuret of one metal acting as an acid, while the sulphuret of another metal acts as a base. The sulphur salts are so constituted, that if the sulphur in both the acid and base was replaced by oxygen, an oxy-salt would result.

The principal *sulphur-bases* are, the protosulphurets of potassium, sodium, lithium, barium, strontium, calcium, and magnesium; and the principal *sulphur-acids* are the sulphurets of arsenic, tin, antimony, tungsten, molybdenum, tellurium, and gold, together with hydrosulphuric acid, and bisulphuret of carbon. Kermes' mineral, an important antimonial medicine, is an example of a sulphur salt, being composed chiefly of sulphuret of antimony, united with sulphuret of potassium.

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## SECTION VI.

### DOUBLE HALOID SALTS.

THESE salts are composed of two simple haloid salts, one of which acts as an acid, and the other as a base, in a manner analogous to the double sulphurets. The principal groups consist of double chlorides, double iodides, and double fluorides.

When an oxide and chloride unite, they constitute a compound known by the name of *oxy-chloride*.

# CHAPTER III.

## CLASSIFICATION OF THE METALS.

CLASS I. METALS OF THE ALKALIES.
CLASS II. METALS OF THE ALKALINE EARTHS.
CLASS III. METALS OF THE EARTHS.
CLASS IV. METALS PROPER.

## SECTION I.

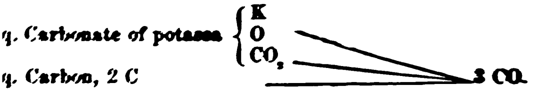
## CLASS I.

## METALS OF THE ALKALIES.

metals of the alkalies are *Potassium*, *Sodium*, *Lithium*,
mmonium.

### POTASSIUM.

overed in 1807 by Davy, by the agency of galvanism.—Pre-
y exposing a mixture of carbonate of potash and charcoal to
heat, in a gun-barrel; the potassium distils over, leaving
e *oxide*, thus:



*p.*—Solid at ordinary temperatures,—soft and malleable be-
the fingers—of a white colour and metallic lustre—brittle at
melts at 150°; sp. gr. ·865,—has a powerful affinity for oxy-
cannot be kept in the air or water;—preserved under naphtha
of copaiva. It takes fire when thrown on water, with the
gement of hydrogen, which combines with a portion of the
um, forming potassiuretted hydrogen, which also takes fire,
ing the brilliancy of the flame;—potash is formed as the
The equivalent of potassium (Kalium) is 39·15; its Sym-

rms two compounds with oxygen, potash, KO, and the per-
$KO_3$.

*xide of potassium* or *potash*, is formed whenever potassium
sed to air or water. In the anhydrous form, it is a white
ory caustic; has a strong affinity for water, with which it
hydrate.

*hydrate of potassa*, KO+HO, also named *common caustic*, and *potassa fusa*, is prepared by decomposing carbonate of potash by lime; the carbonate of lime is thrown down, and the potassa remains in solution; this is concentrated by heat, and then poured out into moulds. Pure hydrate of potassa is a white solid, very deliquescent, soluble in water and alcohol. The common caustic potash may be purified by dissolving in alcohol. The solution, like lime water, rapidly absorbs carbonic acid from the air. The solid hydrate, from its affinity for water, is used to free gases from hygrometric moisture.

*Peroxide of potassium*, $KO_3$, is formed when potassium is burned in dry oxygen, or in the open air; it is of an orange colour.

The most important salts of potassa are the *nitrates*, the *carbonates*, the *sulphates*, and the *chlorate*. The impure carbonate (*pot* and *pearl ashes*) is produced by lixiviating the ashes of inland plants, and evaporating to dryness; it is purified by redissolving in water, and boiling. The pure carbonate (salt of tartar) is made by decomposing cream of tartar by a high heat. Composition, $KO+CO_2$.

The *bicarbonate*, $KO+2CO_2+HO$, is formed by passing a stream of carbonic acid through a solution of the carbonate. It is not so soluble as the carbonate.—A *sesquicarbonate* is said to exist.

The *sulphate*, $KO+SO_3$, is the residue left in the retort in the preparation of nitric acid. The *bisulphate*, $KO+2SO_3$, is more soluble, and has an acid taste and reaction. There is also a *sesquisulphate*.

The *nitrate*, $KO+NO_5$, named also *nitre* and *saltpetre*, occurs native, as an efflorescence on certain soils; it is manufactured also from artificial nitre-beds. Shape of crystals, six-sided prisms;—very soluble;—contains water mechanically confined, which causes the crystals to *decrepitate* when thrown upon hot coals. When heated, it gives off oxygen, and is converted into a *hyponitrite*; a high heat entirely decomposes it. From its power of imparting oxygen, it is the active ingredient in *gunpowder*, which is a mixture of nitre, charcoal, and sulphur. When gunpowder is fired, the oxygen of the nitre combines with the carbon to form carbonic oxide; the sulphur with the potassium; and the nitrogen is set free.

The *chlorate*, $KO+ClO_5$, is remarkable for its deflagrating properties; it yields a large quantity of oxygen gas, on being heated.

*Silicate of Potassa.*—$KO+SiO_3$.—Silicic acid unites in different proportions with the alkalies. If the base be in excess, a soluble salt is formed, called *liquor silicum*; if the acid be in excess, an insoluble salt (*glass*) is the result. Glass owes its colour to the different metals:—*green*, to the oxide of iron; *blue*, to cobalt; *ruby*, to red oxide of copper; *purple*, to the purple of Cassius; *amethyst*, to manganese, &c.

hur, chlorine, iodine, and bromine, also form compounds with
um.

*ride of Potassium*, KCl, is obtained in making chlorate of
, by passing chlorine gas through a solution of potassa. It
esembles chloride of sodium.

*de of Potassium*, KI, is made by dissolving iodine in a strong
n of caustic potash; also by adding iodide of iron to carbo-
potassa in solution; carbonate of iron is precipitated.

*for the salts of potassa.*—1. Tartaric acid in excess gives
ringly soluble bitartrate (cream of tartar). 2. A solution of
e of platinum causes a yellow precipitate. 3. The alcoholic
n of carbazotic acid precipitates the yellow carbazotate of
. 4. The salts of potash usually colour the flame of the
pe purple or violet.

## SODIUM.

istory and mode of preparation are the same as those of po-
.

*o*.—A white metal; resembles potassium in most respects;
·972; decomposes water with great violence, but does not
on account of its rapid motion; if this be restrained by
of gum or sugar, it takes fire and is converted into *soda*.
23·3; Symb. (Natrium), Na. It forms two compounds with
, the *protoxide* (soda), Na O, and the *peroxide*, $NaO_3$; these
med like, and correspond with, the analogous compounds of
um.

*rate of soda*, NaO+HO,—prepared from the carbonate by
ion of quicklime. Very similar in its properties to the hy-
f potassa.

*bonate of soda*, $NaO+CO_2+10HO$. Prepared by lixiviating
es of marine plants, and evaporating; this is known under
mercial names of *barilla*, and *kelp*, which contain many im-
. A purer variety is made by heating together sulphate of
me, and sawdust in a reverberatory furnace. Sulphuret of
, sulphurous acid, and carbonate of soda, are formed. This
in large rhombic crystals, very soluble in water, of a caustic
e taste, and alkaline reaction.

*rbonate*, $NaO+2CO_2+HO$,—formed as the bicarbonate of
. It is less soluble than the carbonate.

*icarbonate*, $2NaO_3+3CO_2+4HO$.—Occurs native.

*hate of Soda—Glauber's salt*, $NaO+SO_3+10HO$; the
left in the process for making hydrochloric acid. A very
salt; more so at 90° than at 212°.—There is also a *bi-*
.

*itrate of soda* is very similar in properties to the nitrate of
—The three *phosphates* are spoken of under the head of
rus.

*Chloride of Sodium—Common Salt*, $NaCl$,—is found in sea-water and saline springs; it occurs also as a mineral, under the name of rock salt; procured by evaporation from its solution. The crystals decrepitate when thrown on hot coals; they are very soluble in water, and are slightly deliquescent.—Iodine, bromine, sulphur, and fluorine, also combine with sodium.

*Test for soda, and its salts.*—All the soda salts are soluble; they communicate a yellow colour to the blowpipe flame. Soda forms with sulphuric acid, the well-known Glauber's salt. Soda is less soluble than potassa.

### LITHIUM.

*Prop.*—A white metal resembling sodium;—procured by electrical action from *lithia*, its protoxide, which is found in petalite, and some few other rare minerals. The *hydrate of lithia* generally resembles the hydrates of soda and potassa, but is less soluble.

*Test.*—It communicates a carmine-red colour to the outer flame of the blowpipe.

### AMMONIUM.

*Ammonium* is the hypothetical metal or radical of ammonia, which has already been treated of under the compounds of Hydrogen and Nitrogen. Its symbol is $NH_4$; that of ammonia (protoxide), $NH_4O$, or, $NH_3,HO$.

*Carbonate of Ammonia*, $NH_4O+CO_2$, is made by the union of carbonic acid and ammoniacal gas. The carbonate of the shops is a *sesquicarbonate*, and is made by subliming together carbonate of lime and chloride of ammonium.—There is also a *Sulphate* and a *Nitrate*.

*Chloride of Ammonium*, or *Sal Ammoniac*, $NH_4Cl$, is one of the products of preparing coal gas.

For the *tests*, see Ammonia.

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## SECTION II.

## CLASS II.

### METALS OF THE ALKALINE EARTHS.

THIS class includes Barium, Strontium, Calcium, and Magnesium.

### BARIUM.

Procured by means of mercury from baryta or its carbonate, through the agency of galvanism, or heat.

*Prop.*—A grayish-white metal, heavier than water; has a strong affinity for oxygen; malleable.—Symb., Ba. It forms two oxides.

*Protoxide*, or *Baryta*, $BaO$.—Occurs in nature as a

sulphate;—may be obtained by decomposing the nitrate by
It has a strong affinity for water, forming with it a hydrate,
e evolution of heat. The hydrate is a white powder resem-
slaked lime; its solution, like lime-water, attracts carbonic
om the air.

*xide of barium*, $BaO_2$, is used in making the peroxide of
en.

salts of baryta are chiefly remarkable for their high specific
; the most important are the carbonate, sulphate, and nitrate.
lphate is very insoluble. The soluble salts are poisonous.
ne, iodine, bromine, and sulphur, form compounds with
.

*for baryta.*—It forms a very insoluble *sulphate*.

### STRONTIUM.

ured as Barium.—Symb., Sr. It forms two oxides.
*toxide,—Strontia*, SrO,—prepared like baryta, which it much
les. Its other compounds are similar to those of baryta.
.—It communicates a blood-red colour to the flame of the
pe.

### CALCIUM.

lver-white metal, procured like Barium;—forms with oxygen
mpounds. Symb., Ca.

*toxide, Lime*, CaO,—obtained by heating the native carbonates.
*p.*—Lime is white,—infusible,—has a strong affinity for water,
g with it a solid hydrate, with the evolution of much heat;
seen in the common process of *slaking*. The hydrate is far
luble in water than those of baryta and strontia; it is more
in cold than in hot water; *lime-water* is thus made. Ex-
to the air, it attracts carbonic acid, forming a pellicle; hence
good test for carbonic acid; it has an alkaline reaction. The
ing of mortar is probably due to the gradual absorption of
ic acid, or to the combination of the sand and lime, forming
*te.*

most important salts of lime are the sulphate, carbonate,
ate, and hypochlorite.

*hate of lime* or *Gypsum*, $CaO+SO_3$, is found native; the
crystals are called *selenite*.
.—A sparingly soluble salt; forms with water a hydrate;—
und in most spring water.

*onate of lime, Limestone*, or *Chalk*, $CaO+CO_2$, is also found
—The purest varieties constitute *marble*.
.—Insoluble in water, but soluble if carbonic acid be pre-
xists in many natural waters, as a supercarbonate, and is de-
from them as *stalactites*.

*phosphate* of lime exists in bones.

Chlorine, iodine, bromine, fluorine, and sulphur form compounds with calcium.

*Chloride of calcium* is prepared by the action of hydrochloric acid on carbonate of lime. It is distinguished for its great affinity for moisture, and hence is of great use to the chemist in removing water from substances; also used for forming frigorific mixtures. The *fluoride* is found native, as *fluor* or *Derbyshire spar.*

*Hypochlorite of lime,* commonly called *chloride of lime,* is the well-known bleaching-powder;—prepared by the action of chlorine on thin strata of hydrate of lime.

*Test for lime.*—Oxalic acid forms an insoluble *oxalate.*

### MAGNESIUM.

Obtained by heating the chloride with potassium. It is a white, malleable metal; heated in the air, it is converted into magnesia.

*Magnesia* is the only oxide, $MgO$.—Prepared by driving off the carbonic acid from the carbonate, by heat. It is a soft, white, insoluble powder.

*Carbonate of magnesia* occurs native; may be easily prepared by double decomposition;—it is very nearly insoluble.

*Sulphate of magnesia, Epsom salts,* $MgO+SO_3+7HO$, exists in sea-water, and certain mineral springs; it is very soluble; forms crystals of a right rhombic prism.

*Phosphates.*—The most interesting is the *ammonio-magnesian phosphate,* or the triple phosphate, $2MgO+NH_4O, PO_5+14HO$. It sometimes constitutes urinary calculi.

*Test for magnesia.*—It forms the well-known Epsom salt with sulphuric acid.

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## SECTION III.

## CLASS III.

### METALS OF THE EARTHS.

THIS class includes Aluminium, Yttrium, Glucinium, Zirconium, Thorium, Erbium, Terbium, Norium, Cerium, Lantanum, and Didynium.

### ALUMINIUM.

Prepared in the same manner as Magnesium. It has a gray colour; of difficult fusibility; forms alumina when burnt in the air.

*Alumina* is a sesquioxide, $Al_2O_3$; exists abundantly throughout nature, as a constituent of the different sorts of *clay;*—prepared by

carbonate of potassa to a solution of alum; the hydrate of
is precipitated.
*erties.*—It has no taste or smell; feels pasty to the tongue;
insoluble and infusible; has a strong affinity for water; acts
ly as a base.
most important salt of alumina is *alum*—a double sulphate
ina and potassa, $Al_2O_3$, $3SO_3+KO$, $SO_3+24HO$, manufac-
om a native alum ore containing clay and sulphuret of iron.
tallizes in octohedrons, is soluble in water, and is converted
*ed alum* by being deprived of its water by heat. Either soda
onia may be substituted for the potassa, in alum. The salts
ina are useful as *mordants* in dyeing. Alumina forms the
f porcelain and earthenware. *Tests for alumina.*—Caustic
and soda give with it white gelatinous precipitates;—the
own characteristics of *alum*;—and the blue colour given by
of cobalt by heat.
remaining metals of the earths are of no particular impor-

## SECTION IV.

## CLASS IV.

## METALS PROPER.

class may conveniently be subdivided into three orders, viz.,
als whose oxides form powerful bases; 2. Metals whose ox-
rm weak bases or acids; 3. Metals whose oxides are reduced
alone,—noble metals.

### ER I.—METALS WHOSE OXIDES FORM POWERFUL BASES.

order includes Iron, Copper, Zinc, Lead, Bismuth, Manga-
obalt, Nickel, Cadmium, Uranium, and Cerium.

### IRON.

rarely occurs native;—exists in *meteorites*, combined with
and cobalt. As an oxide, it is widely diffused throughout
The most abundant ores of iron, are the oxides, and sul-
, or *pyrites*. Some of the ores are magnetic, and some are
ron is extracted from its ores by roasting, and then exposing
gh heat, along with charcoal; by this means the common
*m* is procured; this is converted into *soft* or *malleable* iron
sure to a strong heat, while a current of air plays upon its
; by this means the carbonaceous matter is burnt off, and

the fusibility of the metal is diminished. *Steel* is a carburet of iron, formed by exposing alternate strata of soft iron and charcoal to an intense heat; a direct union ensues, by which the iron acquires greater hardness.

*Prop.*—Iron has a peculiar gray colour—metallic lustre—not very malleable—quite ductile—the most tenacious of all metals;—it is a hard metal—of a fibrous texture—sp. gr. 9·7—is very infusible—susceptible of the welding process—is attracted by the magnet—may itself be rendered magnetic by heating—does not oxidize in dry air at common temperatures;—heated to redness, it becomes covered with a scaly coating of the black oxide—burns vividly in oxygen—rusts when exposed to air and moisture—decomposes water at a red heat, evolving pure hydrogen, and giving rise to the black oxide. *Chemically pure iron* may be procured by passing hydrogen gas over the sesqui or protoxide of iron heated to redness in a porcelain tube. It is sometimes called *pyrophoric iron*;—it is used in medicine. Symb. (Ferrum), Fe.—Eq., 28.—It forms four compounds with oxygen.

*Protoxide*, $FeO$,—the base of the native carbonate, and of green vitriol. It can hardly be isolated, from its great proneness to absorb oxygen, and to pass into the state of sesquioxide; the hydrate of the protoxide is formed when an alkali is added to a solution of the protosulphate; it is of a dirty green colour, and speedily becomes red by the absorption of oxygen.

*Peroxide* (*Sesquioxide*), $Fe_2O_3$—occurs in nature under the name of *red hematite*;—made by dissolving iron in nitro-hydrochloric acid, and adding an alkali. *Prop.*—It is not attracted by the magnet;—forms reddish salts with most of the acids. It can easily be detected by the infusion of galls, which gives with it a bluish-black precipitate, the basis of ink,—by ferrocyanide of potassium, which throws down *Prussian blue*,—by sulphocyanide of potassium, which causes a blood-red colour.

*Black*, or *Magnetic Oxide*, $FeO+Fe_2O_3$,—a mixture of the two former oxides;—occurs native—is one of the most valuable of the ores; it is the product of exposing iron to high heat. It does not form salts.

*Ferric Acid*, $FeO_3$,—only recently discovered—obtained by heating together one part of peroxide of iron with four parts of dry nitre, by which the ferrate of potash is formed; it is very difficult to isolate, on account of its extreme susceptibility to decomposition.

Iron forms two compounds with chlorine.

*Protochloride* $FeCl$,—formed by dissolving iron in chlorohydric acid, and drying.

*Sesquichloride*, $Fe_2Cl_3$, formed by the combustion of iron wire in chlorine gas.—There are also two *iodides*; the protiodide is used in medicine, and is made by digesting iodine in water, with pure iron wire.

Sulphur unites with iron in several proportions.

*Protosulphuret*, $FeS$,—formed by heating iron and sulphur together; it has a blackish colour, and is attracted by the magnet. Ther is also a *Sesquisulphuret*, $Fe_2S_3$.

*Bisulphuret*, $FeS_2$, *iron pyrites*, exists native; it has a yello colour and a metallic lustre; it is not magnetic.

*Magnetic iron pyrites*, is a native ore, consisting of a compoun of the protosulphuret and bisulphuret (Stromeyer).

Cyanogen forms certain important double salts with iron.

*Ferrocyanide of Potassium*, or *Yellow Prussiate of Potash*, $FeC$ $+2K$, is made by heating cyanide of potassium with iron; a co pound radical—*ferrocyanogen*—is believed to be formed in the pr cess, expressed by $FeCy_3$.

*Ferrocyanide of Iron*, *Prussian Blue*, $3FeCy_3+4Fe$, is made b adding ferrocyanide of potassium to a sesquisalt of iron.

*Ferricyanide of Potassium*, or *Red Prussiate of Potash*, $Fe_2C$ $+3K$.

*Ferricyanide of Iron*, or *Turnbull's Blue*, $Fe_2Cy_6+3Fe$.—The last two compounds contain a compound radical, *ferricyanoge* $Fe_2Cy_6$.

The most important salts of iron are the sulphates, the carbona and the nitrate.

*Protosulphate* of iron, *green vitriol*, or copperas, $FeO.SO$ $HO+6HO$, is prepared by dissolving iron in sulphuric acid. It i crystalline—of a beautiful green colour—very soluble, and efflor scent. It is isomorphous with sulphate of magnesia. *Sesquisu phate* of iron,—made by the action of nitric acid on a solution of th protosulphate; it has a buff colour, and is sparingly soluble. The is only one carbonate—the *protocarbonate;* this is sometimes foun native, and exists in chalybeate springs. There are two *nitrates.*

The best *tests* for iron, are those mentioned under the head of th sesquioxide.

## COPPER.

Occurs sometimes in native crystals; but, most commonly, as sulphuret, from which the metal is extracted by roasting wit charcoal.

*Prop.*—The only red metal except titanium; has considerabl lustre; sp. gr. 8·6; is very ductile, malleable, and tenacious undergoes but little change in dry air; but, when moist, it is converte into a subcarbonate. Symb. (Cuprum), Cu.—Eq., 31·6. Coppe forms two or three oxides.

*Dioxide*, or *red oxide*, $Cu_2O$, occurs native, in octohedral crystals It may be formed by heating together the protoxide and coppe filings. It forms colourless salts with bases, which, however, ar very unstable, from their tendency to absorb oxygen.

*Protoxide* or *black oxide*, $CuO$, the basis of most of the salts of copper:—prepared by calcining metallic copper:—by precipitating from any salt by an alkali;—and by heating the nitrate. Its colour varies from a dark brown to a black. There is also a *binoxide*.

There are two *chlorides*, *iodides*, and *sulphides* of copper, similar in composition to the first two oxides.

The most important salts of copper are the *sulphate*, *nitrate*, *carbonates*, and *acetates*. The sulphate—well known in commerce, as *blue vitriol*—is formed by the action of sulphuric acid on copper. The carbonate occurs native, in the mineral *malacite*. *Verdigris* is composed of one or more of the acetates of copper.—The proper solvent of copper is nitric acid.

*Tests.*—Ammonia, in small quantities, throws down from a solution of the sulphate, the bluish-white hydrated protoxide; but when added in excess, it redissolves the precipitate, forming a deep blue colour. Ferrocyanide of potassium gives a fine reddish-brown ferrocyanide of copper.—It is also precipitated upon iron or steel. Copper forms several important alloys, such as *brass*, with zinc; *bell metal*, with tin; and *bronze*, with zinc and lead.

### LEAD.

Procured chiefly from the native sulphuret or *galena*, by roasting, which converts most of it into a sulphate; the sulphate and sulphuret reacting upon one another, produce sulphurous acid, and metallic lead.

*Prop.*—A soft, bluish metal; has a metallic lustre when freshly cut; somewhat malleable and ductile, particularly in the form of pipes; not very tenacious: sp. gr. 11·45; melts at 600° F. Exposed to moist air, it becomes coated with a film of the dioxide; also absorbs oxygen when heated in the open air. Symb. (Plumbum), $Pb$. Eq., 103·6.—It forms four oxides.

*Dioxide*, $Pb_2O$, formed by heating dry oxalate of lead in a retort; it absorbs oxygen very rapidly.

*Protoxide*, $PbO$, the basis of the salts of lead, is prepared by exposing the gray film which collects on the surface of melted lead, and which consists of the protoxide and metallic lead, to a high heat, with the access of air; this constitutes the *massicot* of commerce; when partially fused by heat, it becomes *litharge*; in this state it contains some peroxide. It has a yellow colour, is insoluble in water, unites with acids, forming salts, from which it is precipitated by alkalies as a hydrate, and as *white lead* by alkaline carbonates.

*Peroxide*, *puce*, or *brown oxide*, $PbO_2$, prepared by the action of nitric acid on red lead, which converts it into the protoxide and peroxide. It has a flea-colour, and is insoluble; by heat it is converted into protoxide, and oxygen.

*Red lead*, or *minium*, $Pb_3O_4$, or $2PbO+PbO_2$, considered to compound of the protoxide and peroxide; is formed by ex- g lead to heat in the air, without allowing it to fuse. It heavy, brilliant red powder; decomposed, with the evolution ygen, by a strong heat; and converted into a mixture of pro- e and peroxide by acids. It is used as a pigment, and in the facture of flint-glass.

lorine forms with lead a compound known as *plumbum cor-* , or horn lead. Sulphur forms with lead the well-known *a*, which occurs in cubical crystals. Iodine, bromine, fluorine, phosphorus also form compounds with lead.—The most im- nt salts of lead are the *carbonate* and *acetate;* also the nitrate ulphate.

*rbonate of lead*, *White lead*,—is sometimes found in a native alline state; may be prepared by precipitating from any soluble f lead by means of an alkaline carbonate;—is manufactured by sing sheet-lead in coils to the action of the vapour of vinegar, e temperature of decomposing manure: the lead is oxidized by partial decomposition of the acetic acid, and is then converted he subacetate. This salt is next decomposed by carbonic acid ing from the manure in which the lead is packed. It is a soft, , very heavy powder, insoluble in water; it is much used as a ent.

*etate of lead*, *Sugar of lead*,—made by dissolving litharge in acid; occurs in colourless, transparent crystals; has a sweet ; is very soluble in water, also in alcohol.—There are several *etates* of lead, made by boiling a solution of the acetate in rge.

*trate of lead*, prepared by the action of nitric acid on lead. c acid is the proper solvent of lead;—it is soluble.

*lphate of lead*, prepared by the action of a soluble sulphate on ution of the acetate of lead; it is a very insoluble salt. Cold uric acid has no action on lead; but when boiling, the lead is y oxidized at the expense of the acid. Hydrochloric acid has tion on lead.

*sts.*—The alkaline carbonates throw down the insoluble carbo- ; the soluble sulphates throw down the insoluble sulphate; uretted hydrogen, or a soluble hydrosulphate, throws down the sulphuret; chromate of potassa gives the yellow chromate of and iodide of potassium yields the yellow iodide of lead.

## ZINC.

curs in nature as a carbonate (*calamine*), or as a sulphuret *blende*). It is procured from the former by heat and char- and from the latter by a similar process, after roasting the at a high temperature, the metal, being volatile, comes over stillation.

*Prop.*—A bluish-white metal; has a crystalline texture; sp. gr. 7; brittle at common temperatures; malleable between 250° and 300°; very brittle at 400°; melts at 773°, and at a bright red heat it boils and burns with a brilliant green light, generating the oxide. It is called *spelter* in commerce, and is never quite pure; is slightly tarnished by exposure to the air. Symb. (Zincum), Zn. —Eq., 33.

*Oxide of Zinc*, $ZnO$;—prepared by burning zinc in the air, or by heating the carbonate. It is a white, insoluble powder, the basis of the salts of zinc.

*Chloride of Zinc*, $ZnCl$;—prepared by heating metallic zinc in chlorine, or by dissolving zinc in hydrochloric acid, and drying. It is a white substance, has the consistence of butter, and is hence called *butter of zinc;* very deliquescent, and soluble in water and alcohol.

The important salts of zinc, are the sulphate and the carbonate.

*Sulphate of Zinc, white vitriol;*—made by acting on zinc with dilute sulphuric acid; the water is decomposed, its oxygen going to the zinc, and the hydrogen escaping. It is a white, crystalline, soluble salt.

*Carbonate of Zinc*,—occurs native, and may be formed by double decomposition between any soluble carbonate and the sulphate of zinc.

## CADMIUM.

This metal is usually found associated with zinc, in the reduction of which from its ores, the cadmium, being more volatile, flies off.

*Prop.*—It resembles tin in colour; very malleable; very volatile; sp. gr. 8·7; melts below 500°; when strongly heated, it burns, forming the *oxide.*

## BISMUTH.

Occurs both native and in combination; it may be procured pure by heating the subnitrate with charcoal.

*Prop.*—A crystalline metal, of a reddish-white colour and metallic lustre; when slowly cooled, it yields cubical crystals; fuses at 476°, and in close vessels sublimes unchanged; in the open air burns with a bluish flame, and is converted into the *oxide;* its proper solvent is nitric acid. It forms two oxides. Sp. gr. 10.—Eq., 71.

*Protoxide*, $BiO$;—the basis of all the salts, has a yellow colour; obtained by heating the subnitrate. *Peroxide*, $Bi_2O_3$;—Bismuth unites also with chlorine and sulphur.

*Nitrate of Bismuth;*—made by dissolving the metal in nitric acid, and evaporating. This, when thrown into water, is decomposed into the soluble *supernitrate*, and the insoluble *subnitrate*, which subsides as a white powder.

The best *test* is the formation of the subnitrate; also sulphuretted hydrogen.

### MANGANESE.

Is found in nature as an *oxide;* procured from this by intensely heating with charcoal.

*Prop.*—A hard, brittle metal, of a grayish-white colour, very infusible, sp. gr. about 8; forms *seven* compounds with oxygen, viz.: Protoxide, $MnO$, Sesquioxide, $Mn_2O_3$, Peroxide, $MnO_2$, Red oxide, $Mn_3O_4$, Varvicite, $Mn_4O_7$, Manganic acid, $MnO_3$, Permanganic acid, $Mn_2O_7$. The most important of these, to the chemist, is the peroxide, or black oxide, which occurs abundantly in nature. It is used in the arts, in the manufacture of glass; and by the chemist for procuring chlorine, bromine, and oxygen.

The best *test* for manganese is the play of colours—called the *mineral chameleon*—produced by dissolving manganate of potassa in water. Manganic acid cannot exist uncombined. The changes of colour are owing to the formation of the *permanganate of potassa*, which is red, and the mixture of red and green produces the intermediate colours.

### NICKEL AND COBALT.

These two metals strongly resemble each other: both occur in combination with arsenic. Nickel is found associated with meteoric iron, and is strongly magnetic. Cobalt is not so. Both have a white colour. Nickel is malleable; Cobalt is brittle. Nickel is employed in the arts, in the preparation of *German silver*—an alloy of copper, zinc, and nickel.

The best *test* to distinguish cobalt from nickel, is the fine blue colour communicated by the former to the flame of the blowpipe, when fused with borax.

### URANIUM AND CERIUM.

These are very rare metals, and are of no practical use.

## SECTION V.

### ORDER II.—METALS WHOSE OXIDES FORM WEAK BASES, OR ACIDS.

THIS order includes Tin, Antimony, Arsenic, Chromium, Vanadium, Tungsten, Molybdenum, Columbium, Titanium, Tellurium, and Osmium.

## TIN.

Is found in nature as an *oxide*, from which it may be procured by heating with charcoal. The varieties known in commerce are *block* and *grain tin*.

*Prop.*—Has a white colour, silvery lustre, is very slowly tarnished by exposure to the air; very malleable, quite ductile, soft, and inelastic, and produces a crackling noise when bent backwards and forwards; sp. gr. about 7; fuses at 442°; heated to whiteness, it burns, and is converted into the peroxide. Symb. (Stannum), Sn. —Eq. 58. It forms three oxides.

*Protoxide*, SnO;—formed by adding an alkaline carbonate to a solution of the protochloride; a white hydrated protoxide falls.

*Sesquioxide*, $Sn_2O_3$,—has a grayish colour.

*Peroxide*, $SnO_2$;—prepared either by precipitating by an alkali from a solution of the perchloride, or by the action of nitric acid on metallic tin. Very strong nitric acid has no effect on tin; but, if diluted, violent effervescence ensues from the escape of nitrous acid and binoxide of nitrogen, and the hydrated peroxide is produced; ammonia is also generated at the same time, the hydrogen being furnished by the water.

*Protochloride*, SnCl,—made by dissolving tin in hot hydrochloric acid; occurs in crystals. It is much used as a deoxidizing agent.

*Perchloride*, $SnCl_2$, called the *fuming liquor of Libavius*;—made by heating the protochloride, or metallic tin, in chlorine; it is a very volatile, colourless liquid, emitting dense white fumes on being exposed to the air; it is used as a *mordant* in dyeing.

There are three sulphurets of tin—the *protosulphuret*, *sesquisulphuret*, and *bisulphuret*; the latter is sometimes termed *mosaic gold*.

*Test.*—Solution of chloride of gold throws down, with the protochloride of tin, the *purple of Cassius*.

## ANTIMONY.

Occurs in nature generally as a *sulphuret*, which, in commerce, is called *crude antimony*, while the pure metal is named *regulus of antimony*. It may be obtained from the sulphuret by heating it with iron filings.

*Prop.*—A bluish-white colour—crystalline structure—brittle—sp. gr. 6·8;—at a high temperature it burns in the open air, the vapour condensing in white crystals of the teroxide (*argentine flowers of antimony*); it is acted upon by both nitric and hydrochloric acids. Symb. (Stibium), Sb.—Eq., 129. It forms three compounds with oxygen.

*Teroxide*, $SbO_3$,—prepared by burning antimony in the open air, —by precipitation from a solution of tartar emetic by means of an

ne carbonate, or by the action of carbonate of potassa or soda
e terchloride, when put into water. It is a pale yellow powder
atile—liable to absorb oxygen. It is the basis of all the anti-
l salts.

timonious acid, $SbO_4$,—made by heating the oxide in open
ls ;—a grayish-white powder—insoluble—combines with alka-

timonic acid, $SbO_5$,—made by action of strong nitric acid in
ony ; an insoluble straw-coloured powder; unites with alka-
o form *antimoniates.*

rchloride, $SbCl_3$ (*butter of antimony*),—made by burning
ony in chlorine gas; a soft solid at common temperatures;
put into water, hydrochloric acid and the sesquioxide are
ated, and the latter, combined with some undecomposed chlo-
subsides as the *powder of Algaroth.* There are one or two
chlorides.—There are several *sulphurets*, of which the most
tant is the native *tersulphuret;* it is a lead-gray substance,
e, and fusible. It may be made by melting sulphur and
ony together, or by passing sulphuretted hydrogen through a
on of tartar emetic. There are also a *pentasulphuret* and a
*chloride.*

*rmes mineral.*—Prepared by boiling tersulphuret of antimony
solution of caustic potassa; a partial double decomposition
s, by which an oxide of antimony, and a sulphuret of potas-
are formed; the latter unites with undecomposed sulphuret of
ony to form a sulphur-salt, in which the sulphuret of antimony
acid, and sulphuret of potassium the base. As the solution
this double salt becomes decomposed, the tersulphuret of
ony subsiding along with a variable portion of potassa and
of antimony. This is the *kermes*, which may hence be con-
d as an *oxy-sulphuret.* The mother waters still contain some
above sulphur-salt, together with potassa and oxide of anti-
; and, on the addition of sulphuric acid, the teroxide and
phide are precipitated together, but without the potassa; this
*golden sulphuret.*

most important salt of antimony is *tartar emetic;*—made by
g cream of tartar with the teroxide of antimony. It is a
, crystalline, soluble salt, which gives a brick-red precipitate
ersulphuret) with sulphuretted hydrogen; it also yields pre-
es with the alkalies, earths, tannic acid, &c. It is a neutral
salt—tartrate of antimony and potassa,—the oxide of anti-
merely substituting the water in the cream of tartar (tartrate
assa and water).

## ARSENIC.

sometimes found native, but is generally procured from the
arseniuret of cobalt and nickel, by means of heat.

*Prop.*—A steel-gray colour; metallic lustre; very brittle; tarnishes in the air; sp. gr. 5·9; volatilizes by heat, and, if air be present, is converted into arsenious acid; its vapour has the odour of garlic. Symb., As.—Eq., 76·4. It forms two well-known compounds with oxygen, *arsenious*, and *arsenic* acids; but no basic compound.

*Arsenious acid, white oxide of arsenic, fly powder*, $AsO_3$,—is always generated when arsenic is heated in the open air; that of commerce is derived by roasting the native ores of cobalt. It is quite transparent and glassy when first prepared, but becomes opaque by exposure; volatile at 380°; vapour is inodorous, and condenses on cool surfaces; not very soluble in water; reddens vegetable blues feebly; combines with bases, forming *arsenites;* it has an acid taste, and is very poisonous.

*Arsenic acid*, $AsO_5$,—made by dissolving arsenious acid in strong nitric acid, mixed with a little hydrochloric acid, and evaporating to dryness. It is sour to the taste; much more soluble in water than arsenious acid; forms *arseniates;* is isomorphous with phosphoric acid; when strongly heated, it is converted into arsenious acid and oxygen.

There are three well-known sulphurets of arsenic.

*Bisulphuret* or *Realgar*, $AsS_2$, occurs native;—may be made by heating together sulphur and arsenious acid; colour, ruby-red.

*Tersulphuret* or *Orpiment*, $AsS_3$, is also found native;—made by transmitting sulphuretted hydrogen through a solution of arsenious acid: colour, yellow,—called *king's yellow.*

*Pentasulphuret*, $AsS_5$, made by action of sulphuretted hydrogen on a solution of arsenic acid; it resembles orpiment in colour. The sulphurets are poisonous.

Arsenic also unites with chlorine, iodine, &c.

*Arseniuretted hydrogen*, $AsH_3$, prepared by adding arsenious acid to the materials for generating hydrogen; colourless; odour of garlic; sp. gr. 2·6; burns with a blue flame, generating arsenious acid; a non-supporter of combustion; very poisonous when breathed; slightly soluble in water.

*Tests for arsenic.*—1. Ammoniacal nitrate of silver (made by adding ammonia to a solution of nitrate of silver, until the oxide of silver, which is thrown down, is nearly all dissolved); arsenious acid added to this, throws down the insoluble arsenite of silver of a yellow colour.

2. *Ammoniacal sulphate of copper* (made by adding ammonia to a solution of sulphate of copper), throws down, with arsenious acid, the insoluble arsenite of copper (*Scheele's green*).

3. *Hydrosulphuric acid*, when transmitted through a solution of arsenious acid, precipitates the tersulphuret (orpiment).

4. The production of *arseniuretted hydrogen.*—By adding the

r containing arsenic to the materials for generating hydrogen, rning a jet of this gas, and holding over it a piece of glass or ain, an *arsenical ring* is formed.—None of the above tests can lied on singly. The best method is to *reduce* the arsenic by s of heat and charcoal (or black flux), in a glass tube; by means the arsenical ring may always be produced, and the ar odour of burning arsenic be detected. The proper antidote senic is the *hydrated peroxide of iron*, in a moist state.

e remaining metals of this order are Chromium, Vanadium, sten, Molybdenum, Columbium, Titanium, Tellurium, and Os- . None of them are of practical importance except *chromium*, lts of which are much used in the arts, viz.: *chromate of lead* me yellow), and the *bichromate of potash*. Chromic acid is kable for the facility with which it parts with oxygen; it is, fore, much used in organic analysis.

## SECTION VI.

### DER III.—METALS WHOSE OXIDES ARE REDUCED BY HEAT.

### GOLD.

CURS either pure, in union with quartz, or combined with silver pper. It is usually separated from impurities by amalgamation mercury, which is afterwards driven off by heat. From silver eparated by the process of *quartation*, which consists in adding alloy so much silver as to make the latter constitute three- s of the mass; in which case the whole of the silver may be ed by nitric acid. May be obtained pure by dissolving in ni- uriatic acid, and then precipitating by a protosalt of iron.

*p.*—It has a well-known yellow colour; is the most malleable, ne of the most ductile of all metals; is not tarnished by either moisture; sp. gr. 19·3. Symb. (Aurum), Au. The only t for gold is a mixture of nitric and hydrochloric acids, or , the solution of chlorine which thence results. An etherial on of gold is made by agitating ether with the strong aqueous on; this may be used for gilding. If *protochloride of tin* be to the solution of gold, the *purple powder of Cassius* is thrown Gold forms compounds with oxygen, chlorine, iodine, and ur. Gold coins are always alloyed with copper or silver, which se its hardness. The best *test* for gold is the protochloride of

### SILVER.

Occurs native, and in combination with gold, and other metals; also with chlorine, and sulphur. One of the most abundant silver ores is the *argentiferous galena*. It is extracted either by amalgamation, or by *cupellation*,—the latter process being only applicable to the combinations with lead. Pure silver may be procured by precipitation from a solution in nitric acid, by means of chloride of sodium, and heating the resulting chloride with carbonate of soda.

*Prop.*—The whitest of all metals; has a brilliant lustre; is very malleable and ductile; the best conductor of heat and electricity; sp. gr. 10·5; is not acted upon by moisture or air, unless sulphur be present; its proper solvent is nitric acid; Symb., Ag. It forms two or three oxides, of which the protoxide acts as a base. The most important salt is the *nitrate*, or *lunar caustic*,—made by dissolving silver in nitric acid, and evaporating. The crystals are colourless; very soluble in water; the solution becomes dark-coloured when exposed to light, in contact with organic matter, probably from the formation of an oxide.

The *arbor Dianæ* is made by suspending mercury in a solution of the nitrate: the silver is precipitated in the form of crystals. It is also precipitated by the chlorides, phosphates, chromates, arseniates, arsenites, and several of the metals.

The best *test* is chlorine, or a soluble chloride.

Silver forms compounds with chlorine, iodine, and sulphur.

### PLATINUM.

Occurs only in the metallic state, generally combined with other metals, particularly palladium, osmium, rhodium, and iridium. It is found in grains, which are converted into masses by intense heat and pressure.

*Prop.*—It has a whitish colour; very malleable; the most ductile of metals; the heaviest body in nature; sp. gr. 21·5; is soft; can be welded, like iron; undergoes no change by exposure to air, moisture, or the highest heat of a smith's forge; it can only be fused by galvanism or the oxy-hydrogen blowpipe; it is dissolved by nitromuriatic acid. In its habitudes with oxygen, chlorine, and sulphur, it resembles gold.

*Spongy platinum* has the singular property of causing the union of oxygen and hydrogen gases, producing combustion. This is probably due to the intimate molecular relationship into which the two gases are brought in the pores of the metal.

*Tests.*—A solution of chloride of potassium produces with chloride of platinum a double chloride, of a pale yellow colour; sal ammoniac gives with it a yellow precipitate, which, by heat, yields spongy platinum.

other metals associated with platinum (Palladium, Osmium, m, and Rhodium), need no particular description.

### MERCURY OR QUICKSILVER.

urs in the metallic state; but more frequently as a sulphide oride;—extracted by heat, which sublimes the mercury.

*p.*—The only metal fluid at ordinary temperatures;—has a -white colour, and brilliant lustre; becomes solid at —39°, it is malleable; boils at 662°;—sp. gr. 13·6; that of frozen ry, about 14. Pure mercury is not altered by the air at com- emperatures, but absorbs oxygen when heated. Hydrochloric has no action, nor sulphuric acid, unless concentrated and g; nitric acid, even when cold and dilute, acts upon it, forming ate.

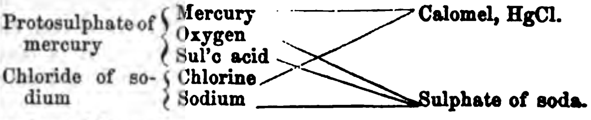
rcury forms two oxides, the *black* and the *red*. The eq. is Turner, Hare), or 101 (Graham, Kane, &c.) The nomencla- of the different compounds will, of course, depend upon the ion of either one of these.

*toxide*, $HgO$ (suboxide, $Hg_2O$).—Prepared by action of caus- tash, or lime, on a solution of the nitrate, or on calomel; it is gray powder, insoluble in water;—decomposed, by the action ht, into the red oxide, and metallic mercury.

*oxide*, $HgO_2$ (protoxide, $HgO$), *red oxide*.—Prepared by the ned agency of heat and air; by heating the nitrate; or by itation from a solution of corrosive sublimate, by means of sa. It is often called *red precipitate*. It is in the form of d shining scales, very slightly soluble in water; converted by nto metallic mercury, and oxygen.

lorine forms two compounds, *calomel* and *corrosive sublimate*.

*tochloride*, or calomel, $HgCl$ (subchloride, $Hg_2Cl$). Prepared by *precipitation*, by means of chloride of sodium in a solution nitrate; or by subliming together the protosulphate of mer- nd chloride of sodium. The rationale is as follows:—



prepared by ordinary sublimation, calomel occurs in yellowish- masses; but if the vapour be conducted into a recipient con- g watery vapour, it is condensed in a very fine white powder. nsoluble, tasteless; sp. gr. 7·2; is apt to contain a little cor- sublimate, which can be removed by washing, or throwing by ammonia. Potassa or lime decomposes it, throwing down ack oxide.

*hloride*, or *corrosive sublimate*, $HgCl_2$ (protochloride, $HgCl$).—

Prepared by burning mercury in chlorine gas; by action of hydrochloric acid on the red oxide; or preferably, by subliming together the bisulphate with common salt, thus:—

| | | |
|---|---|---|
| 1 eq. bipersulphate of mercury | Mercury | Bichloride of mercury, $HgCl_2$ |
| | 2 Oxygen | |
| | 2 Sul'c acid | |
| 2 eq. chloride of sodium | 2 Chlorine | |
| | 2 Sodium | 2 eq. sulphate of soda. |

*Prop.*—Crystalline; soluble in water, alcohol, and ether. The alkalies and their carbonates throw down from it the red oxide; ammonia in excess throws down from its solution the *white precipitate*, which is considered to be an *amo-chloride* of mercury (Kane). This amo-chloride, or *chloramide*, as it is often called, is considered to be a double salt, composed of the *biamide* of mercury and some undecomposed *bichloride*.—*Albumen* is the best antidote for it.

There are two iodides, two bromides, one cyanide, and two sulphides of mercury. The bisulphide occurs native, under the name of *cinnabar;* its powder is called *vermilion*. *Ethiop's mineral* is made by triturating mercury and sulphur together, until the globules disappear; it is considered to be a mixture of sulphur and the bisulphide.

The most important *salts* are formed with nitric and sulphuric acids, each of which unites with the protoxide and the peroxide. The *turpeth mineral* is the subsulphate, formed by throwing the sulphate into water.

The best *tests* for mercury are:—iodide of potassium, which gives with a protosalt the *green* iodide, and with a persalt, the beautiful *red* biniodide;—protochloride of tin gives a black precipitate if heated with a protosalt;—a drop of a mercurial solution put upon a polished surface of gold, and touched with the point of a penknife, instantly causes a white stain, from the amalgam which is formed by the galvanic agency.

# PART III.

## ORGANIC CHEMISTRY.

### GENERAL OBSERVATIONS.

**Organic** substances, whether derived from the vegetable or animal kingdom, are chiefly remarkable for the complexity of their composition, and for the limited number of their elements. Only *four* elements are considered essential to the composition of organic

, viz., carbon, oxygen, hydrogen, and nitrogen,—though are occasionally met with, as sulphur, phosphorus, chlorine, n, &c.; altogether they do not amount to more than fifteen. appears, however, to be no limit to the number of definite unds which may be produced out of merely the four above- essential elements, simply by a difference in their propor- nd mode of arrangement.

consequence of the complexity of organic bodies, they are lly very instable, being prone to decomposition whenever the ning force is removed. The products of such decomposition ter, carbonic acid, and ammonia; and if sulphur be present, uretted hydrogen.

a general rule, the more complex is the constitution of an c body, the more liable is it to decomposition; but this ten- is much lessened if the elements are in such proportions as etely to *saturate* each other; thus, in sugar, starch, and lignin, roportions of oxygen and hydrogen are exactly sufficient to te each other, and to form water.

getable organic matter is usually *ternary* in its composition, s not so prone to decomposition as animal organic matter, is generally *quaternary*. Both are invariably decomposed at.

*meric* bodies are frequently met with among organic sub- s. By this term is meant bodies having the same chemical sition, but possessing very different properties; starch, sugar, um are examples. Isomerism is believed to depend upon a *nt arrangement* in the constituent atoms of a body,—their er remaining the same.

## SECTION I.

### OF COMPOUND RADICALS.

the term *compound radical*, is meant a substance which, gh containing two or more elements, acts precisely as a simple ntary body. The following are the most important of the ted compound organic radicals, together with their chemical sition expressed in symbols.

| | Formula. |
|---|---|
| Carbonic oxide, or protoxide of carbon, - - - | $CO$. |
| Cyanogen, or bicarburet of nitrogen, - - - | $C^2N$. |
| Mellon, or sesquicarburet of nitrogen, - - - | $C^6N^4$. |
| Benzoile, benzule, or benzyle, - - - - | $C^{14}H^5O^2$. |
| Cinnamyl, or cinnamule, - - - - - | $C^{18}H^7O^2$. |
| Salycyle, or salicule, - - - - - - | $C^{14}H^5O^4$. |
| Acetyle, or acetule, - - - - - - - | $C^4H^3$. |

| | |
|---|---|
| Formyle, or formule, - - - - - - - | $C^2H$. |
| Amide, - - - - - - - - - - - | $NH^2$. |
| Ethyle, or ethule, - - - - - - - - | $C^4H^5$. |
| Methyle, or methule, - - - - - - - - | $C^2H^3$. |
| Cetyle, or cetule, - - - - - - - - - | $C^{32}H^{33}$. |
| Glyceryle, or glycerule, - - - - - - - - | $C^6H^7$. |
| Amyle, or amule, - - - - - - - - | $C^{10}H^{11}$. |
| Mesetyle, or mesetule, - - - - - - - - | $C^6H^4$. |
| Kacodyle, or kacodule, - - - - - - - | $C^4H^6As$. |

Besides these, there are some subordinate compound radicals. A few of the above radicals will be noticed now; the others will be spoken of when their compounds come under consideration.

*Amide*, $NH_2$, or amidogen. This compound radical is believed to be generated when ammonia is heated in contact with potassium or sodium; hydrogen is liberated, and a compound formed of amyde and the metal. When the amyde of potassium or sodium thus generated is put into water, this liquid forms ammonia by yielding up hydrogen to the amyde; and at the same time it converts the potassium into potash, by giving up its oxygen. According to this view, ammonia is an amyde of hydrogen. Ammoniated mercury (white precipitate) is a compound of an amyde and the bichloride of mercury.

*Carbonic oxide*, CO, has already been spoken of as a compound of carbon. By combining with carbonic acid, $CO_2$, it constitutes *oxalic* acid, $C_2O_3$. The most important compounds of this radical are *carbamide*, *oxamide*, and *chloroxycarbonic* acid, a compound of carbonic oxide and chlorine.

*Benzule* or *Benzyle*, $C_{14}H_5O_2$,—the hypothetical radical of benzoic acid, and of the oil of bitter almonds. By the addition of an atom of oxygen and an atom of water, it forms benzoic acid. By substituting an atom of hydrogen for an atom of oxygen, benzoic acid is converted into the oil of bitter almonds, or the *hydruret of benzule*. This hydruret does not pre-exist in the bitter almonds, but is the result of the reaction of two organic principles contained therein, denominated amygdalin and emulsin, or synaptase, with water.

Benzule forms a compound with amide called *benzamide*.

*Cinnamyle*, $C_{18}H_8O_2$, has much analogy with benzule. It is the radical of the *oil* of *cinnamon*, and of a few other compounds.

*Glyceryle*, $C_6H_7$, the compound radical of *glycerine*, the hydrated oxide of glyceryle, which is the base common to many oils and fats. Glycerine will be more fully spoken of under the head of Oils.

*Cetyle*, $C_{32}H_{33}$, an organic radical, which performs precisely the same part in spermaceti that glyceryle does in ordinary fats.

## SECTION II.

### ANALYSIS OF ORGANIC BODIES.

all organic bodies undergo decomposition when exposed to a
temperature, in the presence of oxygen, this is the method
ed to effect their analysis; it is founded on the fact that the
t of the carbonic acid and water, resulting from the union of
n with the carbon and hydrogen of the organic body, will in-
the relative propertions of the latter elements. The following
outline of Liebig's method, which is by far the most simple:—
pe of white Bohemian glass, called a ***combustion-tube***, about a
ong, is drawn out at one extremity to a point, which is closed;
rganic substance is mixed with the black oxide of copper (a
ance which readily imparts oxygen when heated with an organic
), and the mass, being thoroughly dried and accurately weighed,
roduced into the tube. To this is attached another tube, con-
ng dried chloride of calcium, to absorb the water that may form;
is also weighed. Lastly, to the end of the latter tube is
ned an arrangement of glass bulbs containing solution of
sa, intended to absorb the carbonic acid that may be formed;
s likewise weighed.

eat is now applied to the combustion-tube; decomposition of
rganic body ensues; its carbon takes oxygen from the oxide of
r to form carbonic acid, every twenty-two grains of which con-
six of carbon. The hydrogen of the organic body also takes
en to form water, every nine grains of which must contain one
drogen.

e result is then easily estimated, by a second weighing of the
ide of calcium tube, and the potash bulbs; the gain of the
r indicating the amount of water, and *one-ninth of this gain*
*sses the quantity of hydrogen*;—the gain of the latter indi-
g the amount of carbonic acid, and six parts in twenty-two, or
*elevenths of this, expresses the quantity of carbon*. Having
ascertained the weight of carbon and of hydrogen, their sum,
acted from the whole weight of the organic body, will give the
t of its oxygen.

the body to be analyzed contains *nitrogen*, an alkali must be
l to convert the nitrogen into ammonia, which is afterwards
rted into chloride of ammonium by hydrochloric acid, next
pitated by bichloride of platinum, and then heated to drive off
lorine and ammonium. The loss of weight gives the data for
ating the amount of nitrogen.

*sulphur* is present, it is to be converted into sulphurous acid, and then oxidized by nitric acid; the sulphuric acid is neutralized by baryta, and from this, the amount of sulphur can be calculated.

In organic analysis, the utmost precision is required in the processes of drying and weighing.

## SECTION III.

### VEGETABLE NON-AZOTIZED SUBSTANCES.

**These** embrace *Gum*, *Sugar*, *Fecula* or *Starch*, and *Lignin*; and, according to Prout, they may be considered as *hydrates of carbon*, since they contain hydrogen and oxygen in the proportions to form water.

### GUM.

This is a proximate principle, which spontaneously exudes from various trees. It is distinguished from resin by being soluble in water and being insoluble in alcohol, and by the action of nitric acid, which converts it into *mucic acid*.

Guerin divides the gums into three classes:—1. *Arabin*, of which gum arabic is the type, soluble in cold water. 2. *Bassorin*, of which tragacanth is the type, which swells into a jelly, but does not dissolve in water. 3. *Cerasin*, from the gum of the cherry-tree; insoluble in cold, but soluble in hot water, by which it is partially converted into arabin.

The *mucilage* of gum arabic differs somewhat from the mucilage of flaxseed: the former is precipitated by the *subacetate* of lead; the latter by the neutral *acetate*.

*Pectine*, or the jelly of fruits, seems closely allied to the gums. It forms *pectic acid*.

### SUGAR.

This is found in various saccharine natural juices, as of the Sugar Cane, the Maple, the Beet, &c. There are several varieties of sugar.

*Cane sugar*, $C_{24}H_{22}O_{22}$, prepared from the juice of the sugar-cane by boiling and evaporating; this constitutes *common brown sugar*; it is refined by dissolving in water, and removing the impurities by means of coagulating albumen. The uncrystallizable portion is named *molasses*. It is converted into grape-sugar by acids and a ferment.

*Grape sugar*, $C_{24}H_{28}O_{28}$, exists in many vegetable juices, especially in grapes. Examples of it are seen in candied sweetmeats, and in raisins; it also occurs in the urine, in diabetes. Grape sugar differs from cane sugar in several particulars: it is less sweet, less

le, and does not form such regular crystals. Strong mineral
have but little effect on grape sugar; the alkalies, on the con-
produce a decided effect. It is the only sugar capable of un-
ing the vinous fermentation; the others being first converted
t.

e best *test* for grape sugar (as in diabetic urine) is to heat it
a little potassa and protosulphate of copper; a characteristic
recipitate occurs, consisting of the suboxide of copper.

*gar of milk*, *Lactine*, $C_{24}O_{24}H_{24}$;—this is the sweet principle
lk: it is procured by evaporating whey. It undergoes fermen-
, like other sugars, but is believed to be converted into grape
in the process.

*nnite* or *Manna sugar*, $C_6H_7O_6$;—this differs from other
s in not undergoing the vinous fermentation. There is also a
from *mushrooms*, and one from *liquorice*.

### FECULA, OR STARCH.

very abundant proximate vegetable principle, abounding in
stems, and seeds. It is procured from flour or potatoes by
ction of a stream of water upon them so as to wash off the in-
le particles of fecula.

*op.*—Insoluble in cold water, alcohol, or ether; appears to be
nogeneous substance, but if examined by the microscope, it is
to consist of granules, having a thin, insoluble envelope;
starch is put into hot water, the envelope bursts, liberating
ontents, which form with the water a gelatinous mass. The
delicate *test* for starch is iodine, which forms with it a blue
r.

e size of the granules of fecula, as shown by the microscope,
very much, according to the source from which it is derived.
v-root, sago, and tapioca, are examples of pure fecula.

the process of the germination of seeds, and of the fermenta-
of malt, the starchy matter of the grain is converted into a
ish, gummy matter, called *dextrine*, and ultimately into grape
. The cause of this remarkable change is due to a peculiar
ple found resident in the grain at that period, named *diastase*,
acts by *catalysis*,—itself undergoing no change.

xtrine has the same composition as starch. It is soluble in
. It is used in the arts as a substitute for gum. Sulphuric
also has the power of converting starch into sugar. Nitric
onverts it into oxalic acid.

### LIGNIN, OR CELLULOSE.

s constitutes the basis of vegetables and of wood. It is pro-
from sawdust by dissolving it successively in water, alcohol,
dilute acid, and an alkaline solution. It has no taste, but

may be converted into dextrine and grape sugar by the action of strong sulphuric acid. In its composition it is isomeric with starch.

## SECTION IV.

### PRODUCTS ARISING FROM CHEMICAL REACTIONS IN THE PRECEDING SUBSTANCES.

### ACTION OF NITRIC ACID.

*Oxalic Acid*, $C_2O_3$, or $CO+CO_2$, is always formed by the action of strong nitric acid on any of the preceding bodies, except gum and sugar of milk. The oxygen of the acid acting upon the sugar, &c., converts it into oxalic acid, producing, at the same time, nitric oxide and water. It occurs in crystals, much resembling Epsom salts; of an intensely sour taste; soluble in water and alcohol; very poisonous. *Test*,—lime forms the insoluble oxalate of lime.

*Pyroxylin*, or *gun-cotton*, $C_{12}H_8O_8+2NO_5+HO$;—prepared by the action of *strong* nitric acid on pure lignin, or cotton; the latter, apparently, undergoes no change, but becomes very explosive. Dissolved in ether, it constitutes *collodion*, so much valued for its adhesive properties.

*Xyloidine*, $C_6H_4O_4+NO_5$,—made by the action of nitric acid on paper. It resembles the preceding.

### VINOUS FERMENTATION AND ITS PRODUCTS.

When a solution of sugar, in connexion with some ferment, as yeast, is subjected to a temperature of 70° to 80°, an intestine movement commences, denominated *fermentation*; bubbles of gas escape, the liquor becomes turbid; but after a while it becomes clear, when the sugar is found to have disappeared, and its place is occupied by alcohol. Such a liquid will yield *alcohol* by distillation. The gas which is generated and escapes is carbonic acid. The chemical change which is produced is the conversion of one atom of anhydrous grape sugar into two atoms of alcohol, and four atoms of carbonic acid.

| | |
|---|---|
| Two atoms of alcohol, - - - - - - | $C^8H^{12}O^4$ |
| With four atoms of carbonic acid, - - - | $C^4\ O^8$ |
| Form one atom of sugar, - - - - - | $C^{12}H^{12}O^{12}$ |

In the process of fermentation, the yeast, or ferment, itself undergoes change, in which respect the action differs from that of *catalysis*.

The various kinds of fermented liquors, such as *wine*, *cider*, *beer*, &c., are made from the juices of different fruits, or from infusions of grain. These all contain sugar and a fermenting principle, and will undergo the vinous fermentation, provided they be exposed roper temperature. The amount of alcohol contained in the nted liquors varies from 3 to 20 per cent. By distilling any e fermented liquors, the different *spirituous* liquors, or *ardent* s, are procured; these contain about fifty per cent. of alcohol; y a second distillation, they yield the commercial alcohol, or *ed spirit*, which has a density of ·835, and which yet contains 14 per cent. of water.

re or *absolute* alcohol cannot be obtained by any number of ations, unless quicklime, chloride of calcium, or sulphuric acid, ployed at the same time, to combine with the water.

re alcohol is colourless and limpid; has a sp. gr. of ·793; is mable, burning with a pale bluish flame, and yielding water arbonic acid; boiling point, 173°; unites with water in all prons; also with ether; has powerful solvent powers; it has never frozen by the most intense cold.

e process of making bread is an instance of the vinous fermen, the yeast added to the dough, converting a small portion of gar into carbonic acid and alcohol. The gas thus liberated, the tough and adhesive mass into bubbles; these still further d by the heat of the oven, which at the same time dissipates cohol.

## TION OF ACIDS ON ALCOHOL—ETHERIFICATION.

hen alcohol is heated with any of the strong acids an *ether* re- The radical *ethyle*, $C_4H_5$, is the basis of all the alcohol series ners. This radical has lately been isolated. Common ether is *ide of ethyle*, $C_4H_5O$; and alcohol is a *hydrated oxide of ethyle*, $O+HO$. Consequently, the conversion of alcohol into ether requires the removal of an atom of water. The rationale then e action of sulphuric acid on alcohol, is merely to remove the upon which the alcohol depended for its existence. There is y any acid from which a peculiar ether bearing its name has een formed, such as *nitric ether*, *acetic ether*, *tartaric ether*, &c. e oxide of ethyle, in consequence of being procured by the of sulphuric acid on alcohol, was formerly called *sulphuric* the name which it continues to bear in commerce; it is also ently known by the simple name *ether*.

*epared* by boiling together equal weights of alcohol and sulc acid, and receiving the products in a vessel surrounded by Various other substances are generated at the same time, such phovinic acid, oil of wine, sulphurous acid, and others. The obtained may be mixed with a little caustic potash, and redisby a gentle heat.

*pp.*—Pure ether is a colourless, transparent, fragrant liquid; . about ·720; boils at 96°; very volatile and inflammable;

burns with a white flame, generating water and carbonic acid. Its vapour has a sp. gr. of 2·586. When mixed with oxygen, it explodes with violence, by means of an electric spark. When ether is transmitted through a red-hot tube, it is decomposed into olefiant gas, light carburetted hydrogen and aldehyde. It is very soluble in alcohol; but only one part is dissolved in ten of water. It may be separated from alcohol by the addition of water, which unites with the alcohol. It is a solvent for oils and fats generally; but its solvent powers are inferior to those of either alcohol or water.

Regarding ether to be a compound of ethyle with oxygen, or an *oxide of ethyle*, it is found that this oxide is capable of uniting with the oxacids, and forming with them compounds analogous to salts. All the halogen bodies, as chlorine, iodine, bromine, &c., unite directly with the radical of ether, just as they do with metallic radicals. The following are some of the ether-compounds :

| | |
|---|---|
| Ethyle, - - - - - - | $C^4H^5$ |
| Oxide of ethyle, ether, - - - | $C^4H^5O$ |
| Hydrate of the oxide, alcohol, - - | $C^4H^5O+HO$ |
| Chloride of ethyle, - - - | $C^4H^5+Cl$ |
| Iodide of ethyle, - - - - - | $C^4H^5+I$ |
| Bromide of ethyle, - - - | $C^4H^5+Br$ |
| Nitrate of oxide of ethyle, - - | $C^4H^5O+NO^5$ |
| Hyponitrite of oxide of ethyle, - | $C^5H^5O+NO^3$ |
| Oxalate of oxide of ethyle, - - | $C^4H^5O+C^2O^3$, &c. |

These compounds of ethyle and its oxide are obtained from alcohol—the hydrated oxide—by the action of the corresponding acids, as on an ordinary metallic oxide.

*Hydrate of oxide of Ethyle, Alcohol.*—This compound can only be obtained through the medium of the vinous fermentation. Its properties have already been described.

*Chloride of ethyle, Hydrochloric Ether.*—Prepared by the action of chlorohydric acid on alcohol, the product being collected in a cold receiver; or else alcohol may be added to the materials for generating the acid, viz. common salt and sulphuric acid. The rationale is precisely similar to that of the action of hydrochloric acid on a metallic oxide.

*Prop.*—A colourless, limpid liquid, very volatile, of a penetrating aromatic odour ;—sp. gr. ·874 ; boils at 52° ; soluble in ten parts of water.

*Bromide of ethyle—Hydrobromic ether;*—a very volatile liquid, heavier than water; of a penetrating odour and taste.

*Iodide of ethyle, Hydriodic ether ;*—very closely resembles the last.

*Sulphuret of ethyle ;*—a colourless liquid, of a disagreeable alliacious odour ; boils at 163°.

*Cyanide of ethyle*—resembles the last.

*Acid Sulphate of oxide of ethyle—Sulphovinic acid,* $C_4H_5O$.

+HO.—Sulphuric acid forms no *neutral* compound with the of ethyle.* Sulphovinic acid is the *acid* sulphate of ethyle. It ned by the action of strong sulphuric acid on alcohol, as in the ration of ether; on cooling, it is diluted with water, and neu-d with chalk, which throws down sulphate of lime; the *sul-nate of lime* is afterwards deposited in crystals: from this, ovinic acid may be obtained by the action of dilute sulphuric It is a sour liquid, very apt to be decomposed into alcohol ulphuric acid; forms *sulphovinates* with bases, which are e.

*osphate of oxide of ethyle*, or *Phosphovinic acid*, is a compound nalogous to the foregoing.

*trate of oxide of ethyle, Nitric ether.*—This compound has only been prepared. It is formed by the action of nitric acid on l, with the addition of urea; the latter substance being requi-o prevent the formation of hyponitrous ether. It has a density 12;—is insoluble in water;—has an agreeable sweet taste.

*ponitrite of the oxide of ethyle, Hyponitrous ether, Nitrous* —This is best prepared, according to Liebig, by the action of itrous acid, derived from nitric acid on starch, on alcohol, and nsing the product. A better method—that of Dr. Hare—is to on hyponitrite of soda by sulphuric acid and alcohol; the pro-eing conducted in a refrigerated receiver. It is a pale, yellow , very volatile, possessing an exceedingly agreeable odour and boils at 62°; sp. gr. ·947. It is the active principle of *spirits of nitre*, which consist of hyponitrous ether dissolved in l.

the same way we have *Carbonic Ether, Oxalic Ether, Acetic , Formic Ether*, &c. &c.

## ACTION OF OXYGEN ON ALCOHOL.

en alcohol is oxidized in the open air, that is burned, the cts of the combustion are carbonic acid and water. But under ar conditions the alcohol may be *dehydrogenized*, i. e., de-l of its hydrogen only, leaving its carbon untouched. From n action there result certain compounds having one common l called *Acetyle*, $C_4H_3$. This differs from ethyle, the radical er, in containing two atoms less of hydrogen, and in forming ounds which are acids instead of bases.

following are some of the acetyle compounds:

| | |
|---|---|
| Acetyle, - - - - - - - | $C_4H_3$ |
| Hydrated oxide (Aldehyde), - - | $C_4H_3O+HO$ |
| Hydrated binoxide (Aldehydic acid), - - | $C_4H_3O_2+HO$ |
| Hydrated tritoxide (Acetic acid), - - | $C_4H_3O_3+HO$ |
| Acetone, - - - - - - - | $C_4H_4O$ |
| Acetal, - - - - - - - | $C_8H_9O_2$ |

---

he *neutral* sulphate of the oxide of ethyle is stated to have been lately isolated.

Acetyle and its protoxide are alike hypothetical.

*Aldehyde, Hydrated oxide of Acetyle*, named from *alcohol dehydrogenatus*, is procured from alcohol or ether, by depriving them of two equivalents of hydrogen by means of oxygen. This is effected either by passing the vapour of alcohol through a red-hot tube; by putting a coil of fine platinum wire around the wick of a burning alcohol lamp; and best, by the action of chromic acid, alcohol being distilled with dilute sulphuric acid, and bichromate of potassa; the aldehyde is condensed in a cold receiver, and redistilled with chloride of calcium.

*Prop.*—A limpid, colourless liquid, having the odour of apples; boils at 72°; sp. gr. ·790. When heated with oxide of silver it causes a deposition of the latter in the metallic form, and is itself converted into aldehydic acid.

*Aldehydic* or *Acetylous Acid*—the hydrated binoxide of acetyle—is procured as just mentioned.

*Acetic*, or *Acetylic Acid*—the hydrated tritoxide of acetyle. If alcohol be presented to spongy platinum, the oxygen condensed into the pores of the latter reacts so powerfully upon the former as to cause its inflammation; but if diluted and slowly added, gradual combustion goes on, and acetic acid is evolved. It is also formed by the destructive distillation of wood. Various fermented liquids when exposed to the air become *sour*, that is, their alcohol unites with the oxygen of the air, giving rise to vinegar. The formula for alcohol is $C_4H_5O+HO$. If to this we add four atoms of oxygen, we have $C_4H_6O_2+4O$, which gives the formula of hydrated acetic acid,$=C_4H_3O_3$, $HO+2HO$.

The vinegar of commerce is chiefly made from wine or cider. The acid from wood is procured by distilling hard wood in close vessels: acetic acid is found among the products which come over; this requires redistillation and some subsequent treatment. This variety is termed *pyroligneous acid.*

The strongest acetic acid is prepared by distilling anhydrous acetate of soda with concentrated oil of vitriol. Crystals of hydrate of acetic acid are formed, which may be drained from the more fluid portion. At the temperature of 63° these crystals fuse into a limpid liquid, of a density of 1·063, possessing the pungent smell and taste of vinegar, and capable of blistering the skin. It is soluble to any extent in water and alcohol. Its vapour is inflammable. The water, which is essential to the constitution of acetic acid, is *basic*, and can only be replaced by some metallic oxide; *anhydrous* acetic acid, in a separate state, is unknown.

The *acetates* are all soluble salts; those of silver and mercury are least so. The most important acetates are the acetate and sub-acetate of lead, acetate of ammonia (spirit of Mindererus), and acetate of copper (verdegris).

tone, or pyroacetic spirit, is a volatile, colourless liquid, which duced when any of the metallic acetates are subjected to a de- ive distillation. It has a density of ·792 and boils at 132°; very inflammable, burning with a bright flame.

distilling together acetate of potassa and arsenious acid, a ance is procured known as the fuming liquor of Cadet. This een proved to be the oxide of a radical, which also has been ed, named *Kakodyle*, $C_4H_6As$—symb. Kd. It forms, like other organic radicals, a large number of compounds, all of are poisonous.

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## SECTION V.

### SUBSTANCES RESEMBLING ALCOHOL.

the distillation of wood, besides pyroligneous acid, there comes an etherial body called *wood-spirit* or *wood-naphtha*. There remarkable analogy between this substance and alcohol; like latter, it is the hydrated oxide of a radical, which is termed *yle*, whose oxide likewise is an ether.

e most important of the methyle series are the following:—

| | |
|---|---|
| Methyle, - - - - - - | $C_2H_3$ or Me. |
| Oxide, or Methylic Ether, - - - | $C_2H_3O$ |
| Hydrated Oxide, or Methylic Alcohol, - | $C_2H_3O+HO$ |
| Chloride of Methyle, - - - - | $C_2H_3Cl$ |
| Sulphate of Oxide of Methyle, - - | $C_2H_3So_3$, &c. |

thyle has not yet been isolated.

*ide of Methyle, Methylic Ether*, is, like common ether, obtained stilling together sulphuric acid and methylic alcohol. It i eous body, colourless, of an etherial odour, inflammable, par soluble in water; freely soluble in alcohol, wood-spirit, and uric acid; sp. gr. 1·617. Its compounds are made precisel the analogous compounds of the oxide of ethyle, only substi g methylic alcohol for common alcohol.

e analogy between the two above-mentioned radicals is stil er carried out in the action of oxygen. By the oxidizement o ol we have formed acetic acid; so by the oxidizement of wood we obtain *formic acid, the hydrated tritoxide of formyle*,— yle being a hypothetical radical expressed by $C_2H$.

*rmic Acid*, $C_2HO_3+HO$, so named because existing in ants, i ned in an analogous manner to that employed for procurin yde, only using wood-spirit instead of alcohol.

*Prop.*—A colourless liquid, of a penetrating odour; boils at 212°; solid at 32°.

No compounds of formyle have as yet been discovered corresponding to aldehyde and aldehydic acid.

*Terchloride of Formyle, Chloroform*, $C_2HCl_3$, made by the action of chloride of lime on alcohol, wood-spirit, or acetone, with the aid of heat. It is a thin, colourless liquid, of an agreeable odour, insoluble in water, but soluble in alcohol and ether; sp. gr. 1·49; boils at 141°; not inflammable.

There is still another alcohol, denominated the *amylic* alcohol, because procured by distilling amylaceous substances, as potatoes. It is sometimes called *potato oil*. It is *the hydrated oxide of Amyle*, another organic radical, and its formula is $C_{10}H_{11}O+HO$ (Amyle $=C_{10}H_{11}$).

Its *oxide*, or *amylic ether*, has been isolated, as well as many other of its compounds.

By oxidation, or dehydrogenation of amylic alcohol (as in the corresponding instances of ethylic and methylic alcohol), we obtain an acid—the *valerianic*, $C_{10}H_9O_3+2HO$; this is the hydrated tritoxide of a new radical not yet named, but expressed by $C_{10}H_9$. Valerianic acid is also procured by distilling Valerian root; and also from sugar of milk, by fermentation and a high heat.

## SECTION VI.

### VEGETABLE, OR ORGANIC ACIDS.

These acids are widely diffused throughout the vegetable kingdom. Many of them pre-exist in the plants; others are the products of the reaction of heat.

*Acetic acid*, $C_4H_3O_3+HO$, has already been treated of.

*Citric acid*, $C_{12}H_5O_{11}+3HO$.—This acid is found in the fruits of the genus *citrus*, including the lemon, sour orange, citron, and lime; also in several others, in combination with malic acid. It may be procured by saturating lemon juice with chalk, and then decomposing the citrate of lime by means of sulphuric acid. The citric acid crystallizes on evaporation. It forms colourless prismatic crystals, very soluble in water, of a very sour taste. The three atoms of water which it contains are essential to its constitution.

*Malic acid*, $C_8H_4O_8+2HO$, derives its name from the apple, in which fruit it largely exists. It may be procured by saturating apple-juice with lime, and decomposing the malate of lime by sulphuric acid. It is a deliquescent acid, without colour, and has an acid taste. It is bibasic.

*ctic acid*, $C_6H_5O_5+HO$, derives its name from the word *lac*, atin for milk. It is the acid which exists in sour milk. It tely been shown to be the product of a peculiar fermentation *viscous*, by which the sugar of milk is converted into lactic It is owing to the generation of this acid, that milk, when becomes *curdled*,—the acid which is formed coagulating the . It is monobasic.

*rtaric acid*, $C_8H_4O_{10}+2HO$.—This is the acid of grapes, tama- and several other fruits, in which it exists combined with sa. The tartaric acid of commerce is prepared from the *tartar* *gol*, an impure acid tartrate of potash, which is deposited from rape-juice during the process of fermentation. The argol, purified, and deprived of its colour, constitutes *cream of tar-* The acid is obtained from this salt by saturating it with car- e of lime, by which it is converted into a tartrate of lime, and rate of potassa; the latter is separated from the former, which oluble, by filtration; the tartrate of lime is then decomposed lphuric acid. It forms colourless, transparent crystals, freely le in water, of a sour taste. As it is bibasic, it requires two alents of a base to form with it a *neutral* salt; hence, the salts it forms with a single atom of a fixed base, have an acid re- , and require the presence of an atom of basic water. Thus, lt heretofore known as bitartrate of potash (cream of tartar) now be considered as an *acid tartrate of potash and water*. salt forms small transparent crystals; it is tolerably soluble in g water, sparingly so in cold water; has an acid reaction and taste.

ere is also a neutral tartrate of potash, called *soluble tartar*, contains two equivalents of the base united to one of acid.

*rtrate of potash and soda,—Rochelle salts;*—made by neutra- a solution of cream of tartar with carbonate of soda. It large prismatic, transparent crystals, freely soluble in water. precipitate cream of tartar from its solution.

*rtrate of antimony and potassa,—Tartar emetic;*—made by g teroxide of antimony in a solution of cream of tartar; the water is displaced by the oxide. Tartar emetic crystallizes in edrons with a rhombic base; very soluble in boiling water; n austere metallic taste. Its solution is decomposed by both and alkalies; the former throws down a mixture of cream of and oxide of antimony; the latter, the oxide. Sulphuretted gen precipitates the sulphuret of antimony.

taric acid is distinguished by forming with any salt of potash ell-known cream of tartar.—Heat converts it into *pyrotar-* *acid*.

*nnic acid*, $C_{18}H_5O_9+3HO$. This is the astringent principle in many vegetables, as the oak, gall-nut, &c.; it is generally associated with gallic acid. It is best procured by pouring commercial sulphuric ether on coarsely-powdered galls, and allowing it to percolate slowly. The water, which always exists in combination with common ether, dissolves out the tannic acid, while the ether takes up the gallic acid and other matters; hence the liquid which has passed through will consist of two distinct strata, the lower one, which is a concentrated aqueous solution of tannic acid, and the upper etherial solution. The latter having been carefully removed, the tannic acid may be obtained by evaporation. It has a light-yellowish colour; of a porous, feathery texture; has a very astringent but not bitter taste; very soluble in water; less so in alcohol; insoluble in pure ether; has an acid reaction.

Tannic acid yields with the sesqui-salts of iron a deep bluish-black precipitate; it also precipitates the solution of tartar emetic, nitrate of silver, sulphate of copper, and acetate of lead; with gelatin it forms a dense whitish compound,—tannate of gelatin, the basis of leather.

The variety of tannin yielded by kino, catechu, and krameria, gives a *greenish*-black precipitate with the salts of iron.

*Leather* is made by soaking hides, which have been deprived of their hair, for a considerable time in an infusion of oak bark: the tannin which it contains combines with the gelatin of the skins.

*Gallic acid*, $C_7HO_3+2HO$, is usually found combined with tannic acid. It is believed to result from the action of the oxygen of the air upon tannic acid. It is not so soluble in water as tannic acid, nor does it precipitate gelatin, but it yields with sesqui-salts of iron a bluish-black compound.—*Writing ink* is a tanno-gallate of iron.

The remaining vegetable acids are of less importance; the most interesting of them are:

*Oxalic acid*, $C_2O_3+HO$, already alluded to.

*Benzoic acid*,—oxide of benzule,—exists in various balsams. It is best procured from gum benzoin by sublimation. It is in the form of white crystals, very light and feathery; exhales a fragrant odour, not due to the acid itself, but to some of the volatile oil; it forms *benzoates*.

*Meconic acid*,—exists in opium combined with morphia and codeia. It is characterized by forming a blood-red coloured compound with a sesqui-salt of iron.

## SECTION VII.

### THE VEGETABLE ALKALIES—VEGETO-ALKALIES.

THE vegeto-alkalies, or *alkaloids*, constitute a peculiar group of compounds. They are met with in various plants, always in com-

ion with an acid, which in many cases, is itself peculiar in it
e, not occurring elsewhere in the vegetable kingdom. The
enerally insoluble in water, but dissolve in hot alcohol. Thei
in solution is usually intensely bitter, and their action on th
l economy very powerful, in consequence of which they ar
greatest value as medicines, containing, as they do, the mo
properties of the plants in which they are respectively found
all contain nitrogen, and are complicated in their constitution
g high combining numbers.

e number of these bodies is very large; only the most impo
will be here noticed.

rphia, $C_{35}H_{20}O_6N+2HO$,—the active principle of opium;—
s in it as a *meconate;* procured from an infusion of opium b
s of ammonia, which throws down the morphia, leaving th
nate of ammonia in solution. It forms small shining crystals
n are colourless; nearly insoluble in water; soluble in ho
ol; forms soluble salts with the acids, the most important o
n are the *sulphate*, *muriate*, and *acetate*.

rcotina, $C_{48}H_{24}O_{15}N$,—exists also in opium; it is separated
the other principles by boiling ether, which yields it on eva
ion.

deia, $C_{35}H_{20}O_5N$—exists in opium as a *meconate;* forms colour
rystals; rather more soluble in water than morphia. Codei
s salts with the acids.

her principles found in opium are *Paramorphia* or *Thebain*
*domorphia*, and *Narceia;* besides *Meconic acid*, which ha
dy been alluded to.

*inia* and *Cinchona*, $C_{20}H_{12}O_2N$ (Cinchonia, $C_{20}H_{12}ON$),—th
e principles of Peruvian bark;—exist in it in combination wit
*acid;* procured from an infusion of bark by the action o
lime, which combines with the kinic acid, liberating the alka
these are then to be taken up by boiling alcohol, and decolor
by animal charcoal.

inia occurs as a whitish powder; it does not crystallize. Cin
is in the form of minute crystals. Both are very insolubl
ater, but dissolve in boiling alcohol. Their most importan
are the *sulphates*, which are soluble in water.

*ychnia* and *Brucia*, $C_{44}H_{23}O_8N_2$ (Brucia, $C_{44}H_{25}O_7N_2$), alkalie
ng in the Strychnos nux vomica, St. Ignatius' bean, and fals
stura bark: they are associated with *igasuric acid*.

*ratria*, $C_{34}H_{22}O_6N$, the alkaline active principle of the *Vera*
*sabadilla*, and of the *Veratrum album*, or white hellebore.

*etia* is the alkaline principle of ipecacuanha. *Colchicina*,—
tive principle of the *Colchicum autumnale*. *Solania*,—th
of the *Solanum dulcamara*. *Caffeia*, or *Theine*,—the activ
ne principle found both in coffee and tea.

We have also *Atropia*, from belladonna; *Aconitia*, or *Aconitine*, from aconite; *Daturia*, from stramonium; *Concia*, from hemlock; *Nicotina*, from tobacco, &c., &c.

Besides the foregoing vegetable alkaline principles, there exist a number of *neutral* principles in plants, possessed of very active properties. Some contain nitrogen, and some do not. The most important of them are *Phloridzin*, *Salicin*, *Asparagin*, *Gentianin*, *Elaterin*, *Cathartin*, *Quassin*, *Lupulin*, *Ergotin*, &c., &c.

## SECTION VIII.

### AZOTIZED VEGETABLE SUBSTANCES.

**These** include *Gluten*, *Vegetable albumen*, *Vegetable fibrin*, and *Vegetable casein*, or *Legumen*. They are sometimes called *vegeto-animal* principles, from their strong analogy with similar principles found in animals.

*Gluten.*—It owes its name to its adhesive property: to it is due the adhesiveness of wheat-dough. It exists chiefly in the seeds of plants, in combination with starch;—may be separated by washing away the starch from wheat flour. It is almost insoluble in water, but soluble in alcohol; gluey when moist, but yellow and translucent when dry. It is a highly nutritious substance. It is owing to it that the rising of wheaten bread is due; the carbonic acid which is formed by the fermentation of the yeast being entangled in the meshes of the gluten, and thereby imparting the cellular structure to the loaf.

*Vegetable albumen*, *Vegetable fibrin*, and *Vegetable casein* also exist in vegetables in combination with gluten. Vegetable albumen is coagulated by heat; vegetable casein is coagulated by acetic acid. The chemical composition of all these principles is nearly, if not quite identical, being $C_{54}H_7N_{15}O_{21}$, with some sulphur.

## SECTION IX.

### OILS AND FATS.

**Oils** are divided into two classes, *fixed* and *volatile*; the former produce a greasy stain upon paper, which is permanent under the action of heat; the stain produced by the latter is removed by heat. There is no essential difference between oils and fats; the chief distinction is in their different degrees of consistency. All of them have more or less attraction for oxygen; some of them to such an extent as to produce spontaneous combustion of light sub-s moistened with them; this is very apt to be the case with *d oil.* From this results the division of fixed oils into drying non-drying. The oils used in painting belong to the first

e parts of vegetables which contain most oil are the seeds; oil is obtained from the fruit itself.

e fixed oils have but slight odour or taste; whenever these ies are found in a fixed oil, they are due to a volatile iple associated with it, as in the case of butter. They are all ible in water, but slightly soluble in alcohol, with the excep- of castor oil, but soluble in ether and in volatile oils.

though oils appear to be homogeneous, they in reality consist veral proximate principles. Of these, the most solid one in al oils is called *stearin;* in vegetable oils, *margarin;* the most l in both is mamed *olein*, or *elain*. These principles may easily olated by submitting the whole to boiling alcohol, which, on ng, deposits the margarine and stearine, but retains the olein. margarine may be then separated from the stearine by ether, he olein from the alcohol by distillation. These three princi- consist respectively of an acid, united with a base. The acid is d *oleic, stearic,* and *margaric;* the base is the same for each; called *glycerine.*

hen any of the fixed oils or fats is mixed with an alkali, a ge takes place denominated *saponification*, resulting in the for- n of a *soap;* the several acids just mentioned quit the glycerine which they were united, and combine with the alkali. Thus non soap, made by the action of potassa on fat, consists chiefly stearate of potassa. If a soap be decomposed by an acid, the cular fat acid of which the soap may have been constituted will ecipitated. The formation of the lead plaster is a true instance ponification, the oleo-margarate of lead being formed, and the rine remaining in solution.

*ermaceti.*—This substance is found in the cranium of a certain es of whale, in union with an oil. It has a crystalline struc- melts at 120°, is soluble to some extent in boiling alcohol, n ether. It is saponified with difficulty, two substances result- called *ethal* and *ethalic acid.*

*ax.*—This substance, whether procured from the bee, or from ollen and leaves of flowers, is found to consist of two distinct iples termed *cerine* and *myricine;* these principles may be sepa- by boiling alcohol.

the fixed oils are compounds of carbon, oxygen, and hy- n.

*latile Oils.*—These are very numerous, and impart the peculiar s to plants. They are procured from the various parts of plants stillation with water, common salt being sometimes added to e the boiling point.

When pure, they are colourless, but they generally have a slight tinge; they have a powerful odour and strong taste; do not saponify; absorb oxygen when exposed to the air; are freely miscible with the fixed oils; are very slightly soluble in water; freely so in alcohol and ether. They consist of two proximate principles, analogous to those of the fixed oils, and named *stearoptin* and *eleaoptin.*

Some of the volatile oils consist solely of carbon and hydrogen, as the *oil of turpentine;* others of carbon, hydrogen, and oxygen; and a few contain sulphur, as the oils of mustard, horseradish, &c.

*Camphor* is a solid volatile oil, having all the characters of the essential oils.

RESINS.—These are generally found in vegetables associated with some volatile oil. Common rosin affords a good example; it is procured from turpentine, which is a compound of rosin and the volatile oil of turpentine. When turpentine is distilled, the oil passes off, leaving the rosin behind.

Resins are insoluble in water, but soluble in alcohol, and in volatile and fixed oils; they are inflammable, and yield on distillation carburetted hydrogen, and several other products; a moderate degree of heat imparts an adhesive quality to them. Some resins resemble fixed oils, in containing two principles, one being more soluble in alcohol than the other. Resins are also susceptible of saponification. Concentrated nitric acid acts upon resins with an explosive violence.

The most important resins, besides *rosin,* are *lac, copal, mastic,* and *dragon's blood.*

*Amber* is a fossil resin.

*Caoutchouc,* or *India rubber,* is an exudation from a tree, resembling both the volatile oils and the resins. It is peculiar in being *elastic.*

*Gutta Percha* is a concrete juice from a tree growing in Borneo. It resembles caoutchouc in many respects.

BALSAMS.—This term is properly used to express a native compound of resin, volatile oil, and benzoic acid, as in the balsams of Tolu and Peru. The name is also improperly given to compounds of resins and volatile oils, as copaiva.

The term *Gum-resins* is applied to a class of vegetable substances, consisting of a mixture of gum and resin, with some other principles: they comprise some of the most valuable medicines, as *opium, gamboge, ammoniac, assafœtida, myrrh, scammony,* &c.

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## SECTION X.

## ANIMAL COMPOUNDS.

*Protein and its compounds.*—The most important protein compounds are *Albumen, Fibrin,* and *Casein.*

*bumen* exists in eggs and the serum of the blood,—being com
l in the latter with soda: the white of an egg affords a good
ple of it. It is not soluble in water, unless a little alkali b
nt; coagulates by heat, acids, creasote, alcohol, and electricity;
es precipitates with most of the metallic salts, particularly *cor*
*e sublimate*, for which it is the best antidote.

is composed of carbon, oxygen, hydrogen, nitrogen, sulphur,
phosphorus;—or supposing *protein* to be represented by Pr,
ormula for albumen would be, $Pr+P+S_2$.

*brin* constitutes the chief portion of muscular flesh; it is also
nportant constituent of the blood, in which it exists in the
le state. It may be procured either from muscle, or preferably,
hipping freshly-drawn blood with a twig; the fibrin adheres to
long white filaments. Its characteristic is its spontaneous
ulation; it is in consequence of this tendency that blood coagu-
when drawn from the body. Its composition is very nearly
ical with that of albumen,—containing one equivalent less of
hur. Albumen is converted into fibrin, in the living body, in
rocess of organization. Its proportion in the blood is liable to
tion by disease.

*sein* is found in milk, and is the basis of cheese. It closely
ables albumen, but differs from it in not being coagulable by
In composition it is nearly identical with the two foregoing
ances, but it contains no phosphorus.

om either of the above three compounds, protein may be pro-
l, by dissolving them in an alkaline solution, and then precipi-
g by an acid.

*elatin and Chondrin.*—These principles constitute the bases of
, tendons, cartilage, and fibro-cartilage, &c. Any of these,
boiled for a long time in water, yield a jelly, which, on cool-
solidifies into *gelatin* or *glue*. *Isinglass* is the dried swimming-
ler of the sturgeon. *Chondrin* is very analogous to gelatin;
procured in the same manner, from *cartilage*. Both are soluble
t water. Gelatin is characterized by giving a precipitate with
c acid,—*tannate of gelatin*.

e different solids and fluids of the body all contain various in-
ting principles, as for example, *blood*, *urine*, *chyle*, *bile*, *bones*,
*-substance*, &c.; but the space here allowed will not permit an
ination of them. In fact, they more properly come under the
ion of PHYSIOLOGY, to which the student is referred for an ac-
of them.

THE END.

A

# HAND-BOOK

OF THE

# PRACTICE OF MEDICINE.

A

# HAND-BOOK

OF THE

# PRACTICE OF MEDICINE:

BEING A PORTION OF

## AN ANALYTICAL COMPENDIUM

OF THE

## VARIOUS BRANCHES OF MEDICINE.

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# PRACTICE OF MEDICINE.

DISEASES may conveniently be divided into two great classes, *general* and *local.* The former includes those which affect the whole system at the same time; the latter, those which affect some particular structure or function, and in which the general or constitutional phenomena are only secondary.

## CLASS I.

## GENERAL DISEASES.

THIS class comprises all the idiopathic fevers, together with the exanthematous or eruptive fevers, and to them we may add Rheumatism and Gout.

### FEVERS.

The term *Fever* is employed in two different senses,—one to denote a peculiar state of the system, which may be present in any disease, and which exhibits itself chiefly by an increase of temperature; the other, to signify certain affections, in which the above, with other symptoms, are usually present; thus we speak of intermittent, remittent, and typhus fever, as special disorders, whilst, in the more general sense, we speak of an individual having *fever*, as an accompanying symptom of, e. g. a pleurisy, a pneumonia, &c. The importance of bearing in mind the above distinction between the application of the term "fever," will be obvious, when it is recollected, that in many of the so-called *fevers* the *symptom* fever may be entirely absent; this is familiar in the cold stage of an intermittent, or as a characteristic condition of fatal cases of adynamic or pernicious fevers.

In fevers there is usually more or less derangement of all the functions, the most striking phenomena being sensorial or nervous irregularity, increased heat of skin, increased frequency of pulse, and loss of appetite, ious premonitory symptoms usually intimate its approach. constitute its *forming stage.* They are a sense of lassitude eariness, general aching of the body, slight chilliness, and onal headache, with disinclination for food. These symptoms ontinue for days, and are sometimes wholly absent. They ost apt to occur in protracted fevers, as the typhus and d.

*cold stage* or *chill* is the first decided evidence of the ex- e of the disorder. Its approach is sometimes gradual, and imes sudden, and it varies much in intensity. The sensation least partly, nervous, though it is often attended with some tion of the temperature of the body. The pains which ac- ny it are purely of a nervous character. Its duration is very le, in some cases not exceeding a few minutes; in others, con- g for hours, or even days.

e cold stage is gradually merged into the *hot stage,* in which is an actual increase in the temperature of the body, rising onally as high as 107°; along with this, there is an increase e fulness and frequency of the pulse, varying however very in this respect, occasionally reaching as high as 150 or 160 per te. There is also generally a flushed face, together with more s pain of head, and increase of sensibility of light and sound.

e *secretions* are always deranged in fever; usually they are ished, or entirely suppressed.

e *declining stage* of fever is frequently marked by the occur- of profuse evacuations from the skin, kidneys, bowels, &c.; are termed *critical discharges.*

e *duration* and *course* of fever varies; it occasionally runs gh all its stages, and terminates in a day; in which case it is l *an ephemera.* Again it may return, after an interval differ- length, when it is named *intermittent.* Again it may par- decline, and afterwards return with its former intensity, when called *remittent;* and finally, it may continue with little or ndency to remission, in which case it would receive the name *ntinued fever.*

o very opposite *grades* of fever exist; the one denominated *inflammatory* (*synocha* of Cullen), marked by an increased activity; the other, the *low, typhous,* or *adynamic,* charac- d by a feeble condition of the vital forces. The term *synochus* sed by Cullen to designate a fever which was inflammatory at ommencement, and typhous towards its close.

e division of fevers into *idiopathic* and *symptomatic* indicates erence in their *cause.* The former term is applied to those arise without any obvious local cause; the latter denotes which are produced by inflammation, or some other local y. Many eminent pathologists have denied the existence of idiopathic fevers, referring them always to some local irritation or inflammation.

Idiopathic fevers are often *accompanied* by inflammation;—thus inflammation of the mucous membrane of the throat accompanies scarlatina; inflammation of the cerebral membranes, or lungs, or intestinal mucous membrane, may occur together with typhoid; hence some eminent physicians have persuaded themselves, that typhoid is not an idiopathic fever, but that it is symptomatic of a local inflammation.

In a symptomatic fever, the local inflammation begins first—in an idiopathic fever, on the contrary, the feverish symptoms begin first, and may continue some time before any local disease appears, if it appear at all.

Idiopathic fevers are most commonly caused by some poison which gets into the blood. Their chief kinds are the intermittent, remittent, continued, and exanthematous; each of which has many varieties.

Symptomatic fevers may be of an acute inflammatory type, or hectic, or typhoid. We may observe here that an intermittent fever is sometimes symptomatic of disease in the urethra, and remittent fever of worms and accumulations of sordes in the alimentary canal.

### CLASSIFICATION OF FEVERS.

1. Irritative fever.
2. Miasmatic fevers.
3. Yellow fever.
4. Typhoid, or enteric fever.
5. Typhus.
6. Small pox or variola.
7. Vaccine disease.
8. Chicken pox.
9. Measles or rubeola.
10. Scarlatina.
11. Erysipelas.
12. Plague.

Of several of these there are varieties, as, for instance, we may have inflammatory, or congestive intermittents or remittents. Some are propagated by contagion, and are hence called *contagious;* some have the property in common that they are attended with an eruptive affection, and are denominated *eruptive*, or *exanthematous fevers.* These are, in many instances, interchangeable terms; most contagious fevers being exanthematous, and most of the exanthemata contagious. Each, however, is distinct individually.

### IRRITATIVE FEVER.

By this is meant a simple fever arising from any irritating cause, but unattended with local inflammation. Usually its duration is very short,—from one to five or six days. If it extend beyond this it is probable that some local inflammation has been developed. It evinces a tendency to remit.

e *symptoms* are those of fevers generally, only milder. In in
it may commence with a convulsion, though this is not ver
ion; during the paroxysm there may be, in them, drowsines
approaching to coma, rendering it liable to be mistaken fo
ocephalus.

*uses.*—Any cause producing irritation. In children, the cause
ore frequent—such as teething, crude ingesta, worms, &c. Henc
s been called *worm-fever.* But, again, it is often nothing mor
a symptomatic fever depending upon some phlegmasia, as en
s, pneumonia, &c.

*eatment.*—A mild saline cathartic, followed by a refrigeran
ioretic. For children, a purgative dose of calomel is especiall
ated. To allay nervous excitement, which is apt to be presen
ildren, we may use sweet spirits of nitre, Hoffman's anodyne
c poultices to the feet, and the warm bath. If crude ingest
spected, give a moderate dose of ipecacuanha. The *diet* shoul
w; for children, cold gum-water is the best.

e convulsions in children are not usually dangerous. They ar
treated by applying cold to the head, and revulsives to th
and, if persistent, by leeches to the temples or behind th

## MIASMATIC FEVERS.

der this name it is convenient to arrange three distinct fevers.
*mittent, remittent,* and *pernicious,* because they all depend upon
entical cause, *miasma.*

e term *miasma* signifies *exhalation.* For want of positive
ledge on this subject, the term is here used to signify *marsh*
*lations.* They are known only by their effects, all attempts
late and analyse them having utterly failed. They have been
cted, but never proved, to be due to cryptogamous or animal
s. The concurrence of heat, moisture, and vegetable decompo-
seems to be requisite for their production. The temperature
be above a certain point, and must be continuous for a definite
Thus in Quebec, St. Petersburg, and other northern cities,
ugh the heat of summer is often excessive, it is too brief to
their appearance. Their intensity increases in proportion as
pproach the equator, where they assume great malignancy.
cease to be developed after a decided frost,—another proof of
vegetable origin. They never originate in the midst of the
, though often along the coast; likewise in low situations sub-
the overflow of rivers, or in the flooding of meadows. Cities
early or quite exempt from them. They evince a great affinity
oisture, hence the greater liability to exposure early in the

morning and in the evening, on account of the condensation of the vapour upon the surface of the earth.

Miasmatic fevers sometimes prevail *epidemically*, a fact which it is difficult to account for. Negroes are less susceptible to their influence than whites.

## INTERMITTENT FEVER.

A disorder characterized by febrile paroxysms recurring at stated intervals, and by the absence of fever between the paroxysms.

*Varieties.*—The three most common varieties are—

1. The *quotidian*, in which the fit comes on every day, generally in the morning, and lasts about ten or twelve hours.

2. The *tertian*, which comes on alternate days, generally about noon, and lasts till evening.

3. The *quartan*, which comes on once in three days, usually in the afternoon. It has the longest cold fit, but the shortest paroxysm altogether. There are also *double quotidians*, having two paroxysms every day. *Double tertians*, having a paroxysm every day, but at different hours. Sometimes there are two paroxysms on one day, and none the next: this is called a *duplicated*, or *doubled tertian*. The *triple tertian* has two paroxysms on one day, and one on the intervening. In *double quartans*, out of three days, two have each one paroxysm, and the other none. Of all these varieties, the *double tertian* is the only one which often occurs.

A distinction is made between the *interval*, and the *intermission* of an ague. The interval, is the space between the beginning of one paroxysm, and the beginning of the next; which in the tertian is forty-eight hours; the intermission, is the space from the *end* of one paroxysm, till the beginning of the next: in other words, the time when the patient is free from the disease; which in the tertian is about forty-two hours. This is also called *apyrexia*. The *type* of the fever has a reference to the length of the interval. Besides the varieties mentioned above, there are *quintans*, *sextans*, *octans*, &c., but they are very rare.

*Seasons of occurrence.*—The *quotidian* commonly occurs in spring; the *tertian* at the end of summer, and beginning of fall; the *quartan* later in the fall.

*Symptoms.*—An intermittent consists of three stages:

1. The *cold stage.*—This begins with chilliness and constriction of the whole body; the nails are blue; the skin is rough (*cutis anserina*), and there are violent shiverings, and chattering of the teeth, headache, and backache, quick, small pulse, oppression at the precordia, and sometimes vomiting. After these have lasted some time, there comes the

2d, or *hot stage*, beginning with flushes of heat, which gradually

ase, till the skin becomes very hot and dry, the face flushed,
emples throbbing, and the pulse full and frequent. After a
ion of from three to eight hours, comes the

, or *sweating stage.*—Perspiration begins on the head and face,
becomes profuse all over the body; and the urine deposits a
us lateritious sediment. Now, in uncomplicated cases, the
nt feels well, but weak, till the next recurrence of the fit.
times one of the stages is wanting, as for instance the cold
; this form is called a *dumb ague.* Sometimes the fever is
ing, or has neuralgic pains substituted for it. The sweating
is also sometimes absent, or is supplied by copious urination,
arrhœa.

*uses.*—Marsh miasmata are the essential causes, though cases
entally occur which are not traceable to this cause. The disease
not proceed from lands which are inundated, so much as from
which *have been* flooded and are drying. It is more virulent
t climates than in temperate—in low situations than in high;
upper stories of a house being much more healthy in aguish
icts than the lower. It is carried about by winds, but inter-
ed by trees; and is always more dangerous by night than by
It is far more likely to attack persons exhausted by fatigue,
perance, or illness, than the healthy: these, therefore, are pre-
sing causes. Cases sometimes occur, which proceed obviously
some temporary irritation, such as the introduction of instru-
s into the urethra, indigestible food in the stomach, worms in
ntestinal canal, &c.

*eatment in ordinary cases.*—In most cases it is well to com-
e with an active cathartic, such as the comp. cathartic pill, so
clear the bowels. If the stomach is very foul, an emetic may
ed, though it is not essential. During the cold stage, warm
s of tea, or wine-and-water, if the patient be feeble, or addicted
s use, hot foot-baths, warm bed, frictions of the spine. The
iquet, applied to the leg and arm of the opposite side, has also
an end to the cold stage. During the hot stage, cool drinks
refrigerant diaphoretics; after the sweating, let the skin be
ed dry with warm towels.

hen the paroxysm is over, begin with some antiperiodic remedy,
event its recurrence. The best is *sulphate of quinine,* of which
two to four grains should be given every four hours, either in
r in solution with a few drops of dilute sulphuric acid, until
twelve to twenty-four grains are taken in the apyrexia. Under
circumstances, it may be necessary to administer the whole
either immediately before or after the paroxysm; as, for in-
e, when the apyrexia is exceedingly short, as in the quotidian.
the whole, however, it is best, if possible, to introduce it into
ystem gradually.

The remedy should be continued in gradually decreasing doses, for ten days or a fortnight after the last fit, as the complaint is very apt to return on the seventh, fourteenth, or twenty-first day after the attack.

If the quinine is rejected by an irritable stomach, it may be injected into the rectum in solution in distilled water, with a drop or two of laudanum; or applied endermically to the epigastrium.

If the quinia cannot be procured, or if it does not produce good effects, the next best remedy is Fowler's solution, in doses of ♏v.—x. ter die. Other remedies are, willow bark, piperine, sulphate of zinc, ammonia, sulphate of copper, and all the vegetable bitters and astringents; but they are much inferior in virtue to the quinine.

*Opium* given in a full dose sometimes puts off the fit, if given just before it is expected; and it is also of great use to shorten the hot stage; but not of much service in the cold.

*Bloodletting*, in the cold stage, was recommended by Dr. Macintosh, but in ordinary cases is now repudiated by most physicians. It may, however, be necessary in the violent agues of hot climates, when there is great internal congestion, or delirium and cerebral excitement.

The great congestion in the abdominal veins which occurs during the cold stage, is very apt to produce enlargements and induration of the liver, and especially of the spleen, the tumour formed by which is commonly called *ague cake;* and the obstruction to the venous circulation caused by these is liable to induce dropsy.

## REMITTENT FEVERS.

Syn.—Bilious fever.—Bilious remittent fever.

In this form of fever, the febrile phenomena evince striking exacerbations and remissions, one paroxysm occurring in the twenty-four hours. It differs from intermittent fever in the intermission not being complete. It is *caused* essentially by marsh miasmata. It is most common in the middle and southern sections of the United States, although it occurs in all parts lying between the northern lakes and the Gulf of Mexico. The localities that it most frequents are the valleys of streams, the borders of lakes and ponds, the neighbourhoods of marshes, and the western prairies. The seasons in which it occurs are the summer and autumnal months.

*Symptoms.*—For several days previous to the invasion, the patient complains of uneasiness at the epigastrium, lassitude, pains in the back, limbs, and head, and restlessness at night. The invasion is attended by coldness of the surface, and frequently by shivering; this coldness is soon superseded by heat, by febrile flushes, or by alternations of heat and cold, by nausea, and occasionally by vomiting. The pains in the head, back, and limbs now become

ated; the mouth is clammy and dry; the tongue white or
; the surface very hot and parched; the face flushed; and
in of the head attended by a feeling of distension and throbbing,
passing into delirium. The pulse is full, hard, and frequent;
is urgent; the bowels constipated; and the urine scanty and
oloured. There is usually more or less epigastric tenderness,
ausea, and often vomiting. The symptoms generally continue
about ten or twelve to eighteen hours, when perspiration
s out; the pulse falls in frequency and strength; delirium
ears, and the irritability of the stomach subsides; there is
y a remission or abatement, but no intermission of the febril
oms. The remission is exceedingly variable in duration, in
cases not lasting more than two or three hours, in others a
day; being shorter or longer, according as the type of the
may be quotidian or tertian. Another paroxysm then occurs,
enerally without any chill, running the same course and ending
e manner, each successive exacerbation becoming, generally,
severe and protracted, and each remission less decided.

e symptoms become now more violent. The remissions dis-
r; the skin becomes dry and harsh, or moist and clammy;
lse small and irregular; the tongue black and crusted; and
omiting, and pain at the epigastrium, more constant. In the
unfavourable cases, yellowishness of the skin occasionally
venes. The bowels become irritable, the evacuations being
y, greenish, and, at last, almost black. The urine is scanty
igh-coloured, or sometimes of a yellowish-brown colour. The
che is intense, accompanied often by vertigo, tinnitus aurium,
elirium.

e disease may run on thus for a time varying from the seventh
fifteenth day, when it either declines with a profuse perspira-
a diarrhœa, or a general subsidence of all the symptoms, or
runs on to a fatal termination. Sometimes it terminates in
ermittent; at others in a continued fever.

### INFLAMMATORY REMITTENT FEVER.

is form differs but slightly from the foregoing in its symptoms
ourse. Violent determination to the brain characterizes the
encement of reaction in this variety; and inordinate affection
e mucous surfaces, the more advanced stages.

### CONGESTIVE, OR MALIGNANT REMITTENT.

s is one of the severest and most fatal of endemic fevers. As
me implies, the disease is of a malignant type from the com-
ment. The great danger here is, that when the patient is
, perhaps with great effort, out of the paroxysm, the practi-

tioner may regard it as incipient convalescence, and neglect the precautions necessary to ward off the next, which may prove fatal.

*Anatomical characters.*—Inflammation of the stomach and bowels is perhaps the most frequent lesion. The glands of Brunner are often much developed, but Peyer's glands are unchanged. The membranes of the brain are sometimes inflamed, and sometimes there is congestion. The liver is often enlarged, more or less softened, and, according to Dr. Stewardson, of a bronze or slate colour. The spleen is also enlarged and softened.

*Complications.*—*Gastro-duodenitis* is among the earliest complications of remittents; in the more advanced stages, *dysentery* occasionally comes on. Diseases of the *liver* and *spleen* are common attendants on remittents. *Determination of blood to the brain* often occurs early in the more severe forms, especially in that form of remittent fever which occurs during the heat of summer, and in large cities. In temperate climates, remittents are frequently associated with *bronchial* or *pulmonary affections.*

*Treatment.*—It was formerly the practice to commence with an *emetic,* but this is not required except there be indications of crude ingesta or an accumulation of bile in the stomach, as shown by frequent retchings, and a bitter taste in the mouth.

In all cases an active *cathartic* is indicated; calomel is the best, in the dose of ten to twenty grains, for an adult, to be followed in the course of four or five hours by some mild purgative; or else it may be combined with jalap or rhubarb; or the comp. cathartic pill may be substituted. If the bowels are very obstinate, purgative *enemata* should be used. After thorough evacuation of the bowels, gentle *laxatives* only are required.

*Bleeding* is only to be employed in case of actual, or threatened inflammation, or active congestion. It cannot cure, or shorten *the fever.* Often topical bleeding may be preferred.

*Diaphoretics* are always indicated in the hot stage, the *effervescing draught* is the best, especially in an irritable condition of the stomach; it may be advantageously combined with tarter emetic and sweet spirits of nitre; or, the antimonial may be used alone, if the stomach will bear it. The neutral mixture and spirits of mindererus are also employed.

If the disease runs on beyond the seventh day, it will be proper to give calomel or blue pill, so as to produce gentle salivation, and Dover's powder at night.

Ordinary cases usually recover under the above treatment, but the best plan is to cut short the disease at *once,* by means of quinine, as soon as a decided remission occurs; at which time from 12 to 24 grs. should be given. When a paroxysm of great violence has been subdued, and there is danger that the next may prove fatal, recourse should be had to the sulphate of quinia, no matter how short or imperfect the remission may be. The quantity must be ent to bring the system under its influence before the next ysm. The remedy should be continued until two daily parox- have been prevented; after which the patient may be consi- safe. Cold sponging is often very refreshing to the patient, hould be discontinued if he complain of chilliness. Any com- ion that may be present will require distinct treatment, ling to the organs that are affected.

ring convalescence gentle *tonics* may be administered.

the inflammatory form, quinine cannot be used; the main ce, then, is upon calomel in large doses, as a sedative, and eral antiphlogistic treatment.

## INFANTILE REMITTENT FEVER.

is disease, though not of miasmatic origin, is conveniently d of in this place. It usually attacks children from nine or onths to twelve or thirteen years old. It generally arises from in diet, and accumulation of morbid matter in the primæ viæ. y also arise from obscure miasmata. Writers in the three last ries imputed this fever to worms, hence the term "*worm* ;" but the presence of worms is rather a complication than a of the affection.

*mptoms.*—This affection commences gradually; the bowels irregular, generally costive, but occasionally relaxed and ted. The child becomes feverish and drowsy towards evening, enerally seems pretty well in the morning. The appetite is ble; the pulse ranges from 100 to 140; and the tongue is d. After these symptoms have lasted for several days, a dis- chill or rigor is sometimes observed; vomiting ensues; and a violent paroxysm of fever, drowsiness, flushed cheeks, and ing pains through the abdomen and head, follow. The child ntly picks its lips and nose; and occasionally stiffness of the great sensibility of the general surface, and tenderness in the of the spine, are observed. In the more advanced stages, ngesta are either thrown off unchanged, or passed undigested the bowels. In very young children, convulsions come on; in of more advanced age, delirium often attends the night exacer- ns. This is the most common form of the disease.

*ute variety.*—This form may occur rather suddenly. The s are irregular, commonly costive; the evacuations are morbid ffensive; the urine turbid, pale, or milky; and the tongue is l, especially at the base. Fever supervenes, and is ushered in gors or chills, the child being hot and restless at night. During xacerbations, the child is drowsy; and if it sleeps, moaning, ng, and even screaming, or incoherence, are observed; some- with vomiting, there is flatulent distension of the abdomen, accelerated breathing and cough. The face is usually flushed; the abdomen and palms of the hands hotter than other parts of the body; and the pulse varies from 120 to 160, according to the age. Occasionally the paroxysm terminates in a slight perspiration, which is often partial; the child falls into a quiet sleep, and the pulse sinks in frequency.

*Diagnosis.*—In infantile remittent fever the cerebral symptoms do not appear until near the close of the disease; in hydrocephalus, they invariably occur before the end of the first week, and oftentimes sooner. The acceleration of the pulse, the remissions and the diarrhœa, which are always constant symptoms of infantile remittent fever, will serve to distinguish it from acute hydrocephalus, in which the bowels are always constipated from the commencement of the disease, and the pulse occasionally slow.

*Chronic form of remittent.*—This form either makes its approach insidiously or follows the acute. The child wastes, the abdomen enlarges, the breath is offensive, and the strength fails. The tongue is white or loaded, but moist, and has often a strawberry-like appearance; the bowels are generally costive, and the evacuations are always unhealthy. The pulse is usually about 100 in the day, but rises to 140 in the evening. There is generally one exacerbation in the twenty-four hours, and it seldom appears before evening, lasting until morning, and terminating in sweats. If the disease be not removed, tympanitic distension of the abdomen, emaciation, harsh discoloration of the skin, enlarged mesenteric glands, chronic diarrhœa, and lientery, supervene.

This affection is liable to be mistaken for chronic inflammation of the pia mater in children.

*Treatment.*—If the affection be acute, and the child strong, leeches should be applied to the epigastrium, calomel and Ipecac. ought to be given at night, and a mild aperient draught in the morning. If the bowels are not evacuated by these means, an enema should be given; equal parts of castor oil and oil of turpentine in water-gruel form the best enema in these cases. The calomel and Ipecac. powder should be repeated every night, or on alternate nights; and a purgative mixture be given in the morning. When the evacuations have been improved by these means, mild tonics may be employed; of these, the infusions of cinchona, cascarilla, and of valerian, form the best; stimulating liniments, and other counter-irritants, should be applied to the abdomen. The *foot-bath*, some mustard flour being added to the water, will be found useful at bed-time. Small doses of sulphate of quinine may be exhibited; and if the disease assume the adynamic form, small doses of chlorate of potassa in an infusion of valerian or of cinchona may be given with advantage. Change of air, especially to a dry and elevated situation, should be recommended. Warm clothing, frictions of the

e, and light, but nourishing diet, are also very beneficial.
g the complaint, farinacea, and weak broth, are the most
le food. Where the disease has produced mesenteric obstruc-
small doses of iodide of potassium may be exhibited. When
lescence is established, the iodid. ferri or Huxham's tinct.
e found useful tonics.

## HECTIC FEVER.

*ctic fever* is a remittent fever, *rarely, if ever, idiopathic,* and
f miasmatic origin, but depending upon some local source of
tion, especially if attended with an exhausting discharge; per-
arising from the absorption of diseased secretions.

*mptoms.*—Hectic fever is attended with great and increasing
ity, a weak, quick, and rather hard pulse, hurried respiration
y exertion, and increased heat of the skin. The exacerbations,
are at first slight, soon become more evident, particularly in
vening; are preceded by a slight or marked chill; are attended
creased heat, which is most evident in the hands and face, the
being at first dry; and terminate in a free, profuse perspiration,
ially the evening paroxysm, which subsides in this manner
in the morning. The bowels are at first costive, but soon
ne relaxed, and colliquative diarrhœa comes on: the urine is
us, generally it is pale, and does not deposit; more rarely, it
h-coloured, and yields a lateritious sediment. While there is
al pallor of the surface, the cheeks present what is very aptly
d the "hectic blush." As the disease advances, the whole
becomes emaciated; the eyes are sunk in their orbits, but are
ant and expressive; the ankles and sometimes the legs are
atous, and the sleep is feverish and disturbed. At last, the
œa and colliquative sweats become more abundant, the respi-
more hurried, and the debility so great that the patient ex-
while making some slight exertion.

*eatment.*—This must essentially depend on the cause or patho-
l state which occasions the hectic fever. Where there is dis-
of the digestive mucous membrane, the treatment consists in
attention to the diet, in improving the condition of the secre-
in the administration of mild tonics, and the occasional
ition of saline refrigerant diuretics, and diaphoretics. Gentle
gents, mineral acids, &c., are useful. Of the acids, sulphuric
in infusion of roses is to be preferred. Anodynes in the
of conium, hyoscyamus, and humulus or opium are occasionally
.

## PERNICIOUS FEVER.

Syn.—Congestive fever.—Pernicious intermittent.—Pernicious remittent.

s term should be restricted to an affection, in which there is great and sudden prostration or deprivation of the nervous power, or, to use a customary phrase, in which the *innervation* is extremely and most dangerously defective or deranged. (Wood.)

This modification of miasmatic fever may be intermittent, remittent, or continued. It is only, however, when of two or three days' duration, that it can be called continued, for if the disease persist, it will almost certainly become paroxysmal. Most frequently it is intermittent; and although often a quotidian, is more frequently tertian in its type.

*Symptoms.*—In some cases the organic functions are most affected; then the evidences of disease are presented chiefly in the organs of digestion, respiration, circulation, calorification, and secretion. In other cases the blow falls upon the animal functions, then the brain is the organ most affected. Of the organic functions, sometimes one is selected in preference to the rest. Thus the force of the morbific cause appears to fall, in some instances upon the heart, in others, upon the alimentary canal, in others again, upon the surface of the body, either in its function of secretion or calorification.

Sometimes it approaches like an ordinary intermittent, at others, with its own peculiar features. It may occur at any hour of the day or night.

When the disease is fully formed and exists primarily in the organic functions, the face and hands are of a livid paleness, the features shrunk and expressive of alarm, the skin contracted and shrivelled like a washerwoman's, the extremities, the trunk, and sometimes even the breath are cold. The surface is, at times, moistened with a clammy perspiration, or bathed in a profuse sweat. The tongue is pale and cold, sometimes dry, sometimes unaltered; there is epigastric tenderness, with great internal heat and intense thirst. Nausea and incessant vomiting are present, with constipation, or the reverse. In the latter case the discharges consist of bloody serum, sometimes of blood, either coagulated or not. The respiration is characteristic, the breathing consists of deep sighs, and with two inspiratory efforts to one expiration. Sometimes it is hurried, irregular, and panting. The pulse is small, irregular, sometimes corded, but oftener feeble, fluttering, and sometimes intermittent. It is almost always frequent, amounting to as much as 120 or even 160 in the minute. With all these symptoms there is great restlessness, the patient attempting to arise from his bed to reach the door or window.

The above symptoms are those which accompany the chill.

The duration of the paroxysm varies; sometimes it will extend over two or three days, mingled with attempts at reaction, sometimes it will last but a few hours, and then reaction comes on, though in no degree equal to the preceding depression, and the

t seems as if about to be restored to health. At other times
ht degree of fever remains; it is only a remission that has
place; again, it may approach more to an *intermission*.

not arrested, the same train of symptoms recurs the next day
day after with increased violence, the second paroxysm often
ng fatal, though sometimes a third occurs, before death takes

metimes the whole force is spent upon the heart, then the pro-
nt phenomena are those of excessive prostration of the circula-
In some cases coldness is the prominent symptom; in others
linary intermittent paroxysm runs its course and ends in pro-
and exhausting perspiration, during which the pernicious
toms appear. When the animal functions are affected the
ysm usually begins with drowsiness, loss of memory, confu-
gradually passing into deep coma, or an apoplectic state with
rous respiration. Pulse full, and either faster or slower than
alth. Sometimes convulsions are present. In some cases
is preceded by delirium.

*use.*—The cause is undoubtedly the same as that of ordinary
nittents and remittents. What it is that gives rise to its pecu-
haracter is unknown; probably a more intense action of the
n, or a greater susceptibility to its influence. The danger does
rise from the *congestion*, but from the *want of innervation*.
calities differ from those of ordinary bilious fever; while the
occupy the table lands, the pernicious fevers prevail especially
low lands skirting the rivers.

*ognosis.*—Exceedingly unfavourable; three-fourths of the cases,
not properly treated, die. Sometimes whole settlements are
off by the disease. If seen during the first or second paroxysm
anger may be averted.

*eatment.*—The first indication is to bring about a reaction as
ily as possible. One of the most obvious remedies is artificial
sinapisms to the extremities and abdomen, or along the spine,
frictions with turpentine or cayenne pepper should be used.
n is useful for its stimulating and anti-emetic properties, and
influence in arresting alvine discharges; it is best adminis-
in substance, but should not be used when there is any affec-
of the brain, as shown by active delirium or stupor. Internal
li should also be administered; of these the sulphate of quinia
best, and may be given even in the paroxysm before reaction,
uld be used, however, in decided doses, and may be employed
y prostrate case, in which it can be borne by the stomach.
ner remedy decidedly called for is calomel, and it may be ad-
geously joined with both quinia and opium. The internal
istration of cayenne pepper is also of great benefit; it may be
in five-grain doses. The proportions of these remedies must

vary to suit the circumstances; so also must the articles employed. If these means fail to bring about reaction, wine or brandy may be given: cold affusion is also recommended, but it should not be carried too far. When coma is present, blood should be taken by cups, or from the arm, if admissible. The treatment in the intermission or remission should be the same as in ordinary intermittent, excepting that the sulphate of quinia should be given in much larger doses, as it constitutes the main reliance. From thirty to sixty grains should be taken from the beginning of one paroxysm to that of the next.

## MILK SICKNESS.

Synonymes.—Trembles, Tires, Slows, Puking Fevers, &c.

This is a peculiar and strongly-characterized endemic disease of several localities in the West.

*Symptoms, &c.*—There are two forms in which we meet with this disease,—the acute, and subacute or chronic. To the first the name of *milk-sickness* is usually given, and to the latter the expressive title of *slows*. They are, however, the same disease, produced by the same cause, and differing in degree only. In the subacute form, the individual is languid, unable to make any exertion of body or mind, appetite variable, bowels rather torpid, palpitation of the heart, slight stiffness of the limbs, trembling, and nausea if any considerable exertion is made, or if taking food is deferred beyond the usual time. After a variable period, and unless removed by the sanative efforts of nature, or by a proper course of remedial treatment, the disease assumes the acute form. The individual is suddenly seized with extreme nausea, prolonged vomiting, faintness, and prostration; the temperature of the body and extremities falls below the natural standard; the skin often grows cold and clammy; great distress and anxiety are depicted upon the countenance, the patient experiencing an undefined and aimless dread; the breath acquires a peculiar fœtor; the tongue is swollen; the bowels become obstinately constipated, and strong pulsation is observed over the whole abdomen, but especially marked to the right of the umbilicus. Cephalalgia, tinnitus aurium, &c., are common accompaniments. The heart and large arteries beat with violence, whilst the pulse at the wrist remains almost natural. The tongue is in most cases but slightly coated or changed from its natural appearance. A complete retroverted action of the stomach comes on, and at every effort of vomiting a fluid is ejected of variable appearance: it is sometimes colourless, sometimes like soapsuds, at others like indigo, and in the last stage of cases that terminate fatally, it is of a dirty brown, with a dark-coloured sediment. But, in all, it has the peculiar smell of the disease, and is generally represented by the

nt as having a sweetish and most sickening taste. As the
dy advances, sharp pains in the limbs and neck are experienced;
gastric pain also comes on, accompanied by a peculiar and
se sense of heat at the præcordium, causing the patient to call
oudly for water to allay the burning sensation.

e pulse now increases in frequency, the face and extremities
nately flush and become cold, evacuations of blood take place,
the vomiting becomes so violent that every article of diet,
, or fluid medicine is ejected. During the intermission of
ting, the patient usually lies upon his back, tossing his limbs
t, and sometimes in a partially comatose state, but is at all
easily aroused when addressed. The irritability and retro-
d action of the stomach continue throughout the disease, until
lescence restores the sufferer, or death closes the scene.

*ture, cause, &c.*—Of the nature and direct causes of this dis-
but little is known. When it first made its appearance in the
ern country, the inhabitants of the infected district were obliged
emove, or suffer terribly from its poisonous influence. It
at first supposed by many to be a variety of malarial fever,
others considered it a species of congestive fever, generated
peculiar atmospheric miasma. More extended observations,
ver, showed that certain locations in the West have been,
their first settlement, and still continue to be, subject to this
iar disease; whilst other neighbouring localities, have always
exempt; that wherever this disease prevails in the human
es, the lower animals are liable to a peculiar and fatal disease,
l *Slows* or *Trembles;* and that, in the human species, the origin
e disease is in some specific poison, obtained, in most cases, from
ilk or flesh of animals that have fed on these infected lands.
t is the local cause or specific virus which invades these districts,
ing the disease, we do not know; as no two that have experi-
ed or written upon this subject agree.

periments upon the authority of Graaf, Simpson, and others,
that it may be caused by the flesh, milk, butter, cheese, &c.,
imals affected with the poison, whatever that may be. Some
attributed the infection of the cattle to their having eaten of
ndian Hachy, or of some species of Rhus, or a peculiar fungus,
mushroom, &c. Others contend that it is of mineral origin,
g it to certain poisons existing in the soil, as arsenic, cobalt,
while another party think it is dependent upon some aerial
n. Accounts conflict, as each observer judges from the promi-
features of his own locality, which may differ in every respect
that of another.

t it is not caused by the water, of which the cattle drink, is
by the fact, that the disease appears in narrowly closed dis-
as sugar orchards, where there is no water; and, moreover,

water, in which the poisoned meat was boiled, remained unaffected, while the beef still retained its poisonous properties; thus fairly proving that the poison is not soluble in water.

The theory of the vegetable origin of this malady is strongly confirmed by the following facts. The disease makes its appearance in all kinds of soils, though *cultivation* generally *destroys* the poison. The cause, whatever it is, affects the cattle grazing at *night*, and even during the day, the *woods* are dangerous to them. Those animals, that have been gradually accustomed to the pasture of affected districts, suffer much less than others, and, only, after a long time. Cows and sluts, exposed to the poison during lactation, generally escape, while their offspring die. While grazing and browsing animals, only, are affected by the original cause, their flesh will reproduce it in all animals; and when the flesh is rejected immediately after being swallowed, the attack is not so bad.

The strongest argument, however, for the vegetable origin of the virus producing the disease, is the known fact, that *carnivorous* animals have the disease only after preying upon the carcasses of graminivorous and herbivorous animals that have died of the complaint.

*Mortality, prognosis, &c.*—The mortality is variously stated. Dr. Banks lost 3 out of every 6 cases; Graaf 5 out of 6; and Hilbert's mortality was only 5 per cent. Austin, another writer, lost 2 out of every 13.

After death the spleen is found dark and congested, the brain softened, and the blood uncoagulated.

When the disease is overcome by proper remedial agents, the heart and large arteries begin to return to their natural pulsations. The irritability of the stomach subsides, and the vermicular motions of the intestines can be perceived; the skin and extremities take on their natural heat, and, after a thorough purgation, the patient generally recovers speedily.

Tendency to coma after vomiting is a very fatal sign.

*Treatment.*—The prominent indications in the treatment of milk-sickness, are to allay gastric irritation, to relieve the affected organs, to remove constipation, and, lastly, to counteract the debility and exhaustion of the latter stages.

The utility of venesection has been disputed. As the disease, however, appears to be a modified form of cerebro-spinal meningitis, the only difference being the less strongly marked cerebral manifestations, and the more diffluent blood, much benefit might be expected from cautious topical bleeding.

Emetics generally do harm; while purgatives are necessary throughout the entire course of the disease.

The burning sensation at the præcordium may be allayed by the administration of alkalies; such as the ordinary soda powders, with half the usual quantity of acid.

lomel may be administered with a view to its sedative effect
the gastric mucous membrane, as well as its cathartic action.
ould be repeated, in large doses, every four or six hours, until
owels are evacuated; and, in cases of extreme irritably, it may
mbined with opium. Stimulating injections are often service-
in promoting the action of the bowels. When the stomach will
it, a full dose of castor oil, combined with spirits of turpentine,
act beneficially after calomel.

apisms and blisters should be applied early in the disease, if we
any benefit from them.

some instances, when the constipation of the bowels is over-
, and the vomiting ceases, there is a strong tendency to a
oid state, requiring the free use of tonics and stimulants.
re the exhaustion is great, spirits, brandy, whiskey, or hot
, should be freely administered. In both the acute and chronic
s of this disease, alcoholic liquors can be taken in large quanti-
without producing any intoxicating effects, and are, indeed, of
importance as remedial egents.

his experiments, Graaf found, that a strong infusion of galls
he effect of neutralizing the poison. Hence, much good might
pected from the judicious use of this and other analogous as-
ents.

## YELLOW FEVER.

ynonymes.—Typhus Icterodes.—Bulam Fever.—Vomito negro.—Vomito prieto.

is is a disease of warm climates, depending upon a special
, occurring mostly during the summer months, and ceasing on
ppearance of frost. It is met with chiefly in towns upon the
ard, or upon streams emptying into the ocean.

*mptoms.*—The attack may or may not be preceded by pro-
ic symptoms, very often coming on without any warning, and
ring in the midst of ordinary health. It is generally ushered
th a chill, and severe pains in the back and limbs. After
e reaction has been established, the skin is hot and dry, the
ation hurried, the face flushed, the eyes red and watery, and
onjunctiva much injected. There is a sense of uneasiness,
imes tenderness at the epigastrium, accompanied by nausea
omiting. The tongue is at first moist and covered with a
ish-white fur; there is also extreme thirst. The pulse ranges
the natural standard to 120 or even 140. Sometimes it is un-
lly slow; either extreme is significant of great danger. Some-
there are delirium and prostration; at others, the mind is clear,
e muscular strength unimpaired. The bowels are ordinarily
, and when the discharges are obtained, they are commonly
lthy in character. As the disease advances the pain in the
becomes more intense, especially in the lower extremities, the

calves and front of the legs. This stage is called by some authors *the stage of invasion*, and lasts from a few hours to three days; the shorter the duration, the more violent, generally, is the disease.

After this comes the stage of remission, or, as it is sometimes called, *the stage without fever*. All the symptoms abate, and the patient seems to be convalescent; there are symptoms present, however, by which the experienced are warned of the continuance of the disease. It is not the same as the remission of bilious fever, but is produced by the exhaustion of the powers of the system. The epigastrium is even more tender upon pressure, the skin becomes yellow or orange colour, the urine assumes a yellow tinge, and the pulse sometimes sinks as low as forty in the minute. After a short calm the stomach assumes its former irritability, and the peculiar substance called *black vomit* is ejected. The tongue is dry, brown, and chapped. The patient becomes more and more prostrated; there are, at times, passive hemorrhages, at others, suppression of urine, or retention. The pulse becomes more and more feeble, the respiration sighing, the matter ejected from the stomach is brought up without effort, and discharges of the same matter take place from the bowels. This stage is sometimes called the *stage of collapse*. Sometimes, instead of collapse, symptoms of reaction set in, which are always to be regarded as a salutary effort of nature, sometimes terminating in health, sometimes, however, running on to extreme exhaustion, or assuming a typhoid form.

*Anatomical characters.*—The membranes of the brain are often found injected, and serum effused into the ventricles. The stomach usually presents traces of inflammation, having its mucous coat either reddened, thickened, softened, or eroded. The peculiar matter called black vomit, is now generally believed to be blood altered by admixture with the acid secretion of the stomach. The liver is altered in colour and consistence. According to Dr. J. Hastings, late of the U. S. N., it resembles old boxwood in colour, and is much harder than natural. Sometimes it is dry and anæmic, though rarely inflamed. It varies in colour from a lemon-yellow to a straw colour, and in consistence, from being soft and friable to positive induration.

*Cause.*—Speculation is rife as to the cause of this disease. There is no doubt that it is as specific as that of small pox, though of its precise nature nothing definite is known. Heat and filth, alone, are not able to produce it; neither are marsh miasmata, independently of other causes. The idea that it is owing to the same cause as that which produces remittent fever, is erroneous; for in many parts of the world where the latter disease is constantly occurring, yellow fever has never been known; again, yellow fever especially prevails in large towns; this is not the case with remittent fever. Acclimated persons are very seldom attacked with yellow fever, it is well known that one attack of bilious fever secures no tion from another. Nor are the symptoms of the two diseases the first stage of yellow fever is *continuous* for one, two, or days, while bilious fever remits from the first.

nay be that a peculiar *animal* miasm is generated under the ar circumstances which are connected with the origin of yellow or possibly it may be caused by *organic germs* which, lodging calities peculiarly adapted to their development, grow and y spread themselves. Epidemic influences materially aid in ninating it though they never actually originate it.

regards its *contagiousness* the weight of evidence and authority idedly opposed to it. Strangers are more liable to it than long nts, and whites more than negroes. Among the predisposing s are exposure, intemperance, fear, and sudden changes of ier.

*agnosis.*—At first it is not easy. As the disease advances, ver, the severe pains in the back and lower extremities, the iar injection of the conjunctiva, the excessive irritability of ch, the yellowness of the skin, and finally the black vomit, iough to diagnosticate the disease.

*ognosis.*—Generally regarded as unfavourable, though much ds upon the person attacked, the character of the epidemic, he severity of the symptoms. Symptoms of great prostration ery unfavourable, and a total suppression of urine is a certainly sign. Strangury, however, is regarded as a favourable sign.

*eatment.*—Early in the disease, before there is much irritability mach, an emetic is of great service, particularly if the stomach ided; it should only be used, however under these circum- es. Bloodletting, to be of service, should be employed early, ven then, not unless called for by the violence of the symptoms he state of the pulse. Mercurials are, on all sides, declared of great service in this disease. They should be administered vith a view to their cathartic action, and then to their specific nce, as rapidly as possible. Febrifuge medicines are also called of these perhaps none is so good as ice given internally, toge- with cool sponging externally; the latter with caution. Ice ften allays the excessive irritability of the stomach. To the end the effervescing draught may be employed, and sinapisms ches externally. If the pain in the head is very great, cups ches may be employed, together with cold applications to the

In the *second stage*, the febrifuge and depleting remedies l be suspended, except the mercurials, to which may be added etate of lead, with a view of diminishing the inflammation of omach, and also for its astringent properties. Blisters may e applied to the epigastrium, and the raw surface sprinkled cetate of morphia.

In the *third stage* cordials and stimulants are demanded. Sulphate of quinia, infusions of bark, or serpentaria, carb. of ammonia, capsicum, turpentine, wine whey, or brandy and water, may be administered. External stimulants, as frictions, sinapisms, hot baths, &c., may also be found beneficial. The apartment should be kept well ventilated, and all excrementitious matters removed.

## TYPHOID FEVER.

**Syn.—Common continued fever.—Enteric fever.—Typhus mitior.—Nervous fever.—Abdominal typhus.—Mucous fever.—Entero-mesenteric fever.—Follicular enteritis.—Dothinenteritis.**

The term *Typhoid* as applied to this disease is regarded by some as objectionable, as it expresses only a condition common to many other disorders.

*Symptoms, course, &c.*—The disease is sometimes preceded by prodromic symptoms. There is a sense of weariness, languor, and general uneasiness, slight headache on rising in the morning, dulness of intellect, irregular flushes of heat, or chilliness, slight acceleration of pulse, furred tongue, and a disposition to diarrhœa. These symptoms may last from several days to a week or more, after which the disease is established by the occurrence of a chill followed by the ordinary phenomena of fever.

The disease being fairly established, there is increased frequency of pulse, ranging from 90 to 110 or 120; the latter usually in females; as a general rule, the pulse is under a hundred. There is headache, with a dull, heavy expression; pain in the back and limbs; restlessness and insomnia; epistaxis, and yellow watery diarrhœa.

As the disease advances these symptoms become aggravated, the pulse is more frequent and strong; the skin hot and dry; the tongue, dries and becomes red at the tip and edges: there is pain in the right iliac region, with a gurgling sound upon pressure; tympanitis is also present, and there also appears about this time, symptoms either of bronchitis or pneumonia.

About the seventh or ninth day, if the surface of the abdomen be examined carefully, there will be discovered upon it a number of small, round, red spots, disappearing upon pressure: these are called the *rose-coloured spots*, or *taches rouges*, and constitute a characteristic eruption. They are about one line in diameter, and are slightly elevated. At the same time, or sometimes not until a week later, a crop of vesicles will also be detected upon the neck and thorax, called *sudamina.*

All the symptoms at this period are aggravated, delirium supervenes, with ringing or buzzing sounds in the ears, followed by dulness of hearing or deafness. The eyes are injected, the tongue becomes incrusted with a black coating, which often cracks and peels off, leaving the raw surface exposed, and the teeth are covered with

. The pulse becomes more feeble and frequent, there is a
uttering delirium, and sometimes twitching or spasm of the
es. As the patient becomes more feeble he slips down to the
of the bed; there are involuntary evacuations, hemorrhage
the bowels or other mucous surfaces, with petechiæ and
s upon the skin, with great liability of the skin to slough.
s the usual course of the disease when it terminates unfavour-

If the disease is to terminate favourably, the symptoms
the countenance brightens, the tongue cleans, the pulse lessens
quency, and the evacuations become more healthy. If the
e ceases to clean and if it again become dry, it indicates an
se of intestinal disease. It often happens that at this time
maciation becomes more evident than it was before.

metimes in the course of the second week, the patient is seized
intense pains in the abdomen, vomiting of green, bilious mat-
a small fluttering pulse, syncope, constipation, and coldness of
xtremities. The cause of these symptoms is perforation of the
ine, and escape of its contents into the cavity of the peri-
m, producing inflammation. It occurs most frequently in the
forms of the disease, and is almost uniformly fatal.

*atomical characters.*—There is scarcely an organ of the body
nay not be the seat of some anatomical lesion. Those which
nsidered characteristic of this fever, however, are thickening,
ing, and ulceration of the glands of Peyer; the condition
ng with the stage of the disease. Enlargement, softening, and
tion of the mesenteric ganglia, more especially those corre-
ing with the morbid patches in the intestine, and, according
me writers, ulceration of the solitary mucous follicles of the
. These ulcerated patches are not due to previous inflamma-
but to the deposit of a peculiar dark matter from the blood,
l *typhous* or *typhoid matter*, beneath the mucous membrane, so
elevate the patches of Peyer above the surrounding surface.
endency of this matter is to soften; this causes the mucous
o give way.

her lesions met with are ulceration of the pharynx and epi-
c cartilage, softening of the spleen, sometimes of the liver and
ys, hepatisation of the lungs, softening of the heart and some-
inflammation of the meninges of the brain with effusion.

lood drawn in this disease is generally deficient in fibrine, and
l by some authors to contain an excess of blood-corpuscles;
s doubtful.

*use.*—On this point little is definitely known. It attacks all
s, rich and poor, though it is often generated where a number
rsons are crowded together, with unwholesome, or insufficient
and confined and vitiated air. It cannot be said to be con-

tagious, since it is very seldom if ever communicated in isolated cases.

*Age* is a predisposing cause. It rarely attacks those beyond thirty. Strangers are more liable than long residents, and males than females. It may occur at any season, but most commonly in the autumn and winter. It rarely occurs more than once, hence, perhaps, its comparative infrequency in the aged.

*Diagnosis.*—By the slowness and insidiousness of the attack; by the diarrhœa; the dusky hue of the countenance; the epistaxis; the gurgling in the right iliac fossa; the tympanitis; the rose-coloured erruption; the stupor and delirium; the appearance of the tongue; and lastly, by the duration of the disease, and the peculiar musty smell when the skin is dry, and acid smell when it is moist.

*Prognosis.*—Not even the mildest cases can be looked upon as free from danger, and on the other hand there is no condition so low, no symptom so fatal, that death should be considered inevitable. Among the unfavourable symptoms, are constant delirium, a belief on the part of the patient that nothing ails him, a sudden shifting of position on the elbows, deep coma, stertorous respiration, great subsultus, rigidity of the limbs, profuse diarrhœa, or hemorrhage from the bowels, great prostration and frequency of the pulse, and excessive tympanitis. The favourable symptoms have been already mentioned.

*Treatment.*—This should usually be commenced by some mild laxative, such as a small dose of sulphate of magnesia, castor oil, rhubarb and magnesia, or a seidlitz powder, according to the nature of the case. The practitioner should always bear in mind the diarrhœa, or the tendency to it, and avoid all irritating and drastic cathartics. The next thing is to obviate febrile symptoms. This may be done by venesection, when the pulse is full and strong, and there is sanguineous determination to the brain, though as a general rule, it had better be omitted; it cannot arrest the disease. The protracted duration of the disease, must also here be borne in mind, and no blood drawn unless imperatively demanded. Leeches, or cups to the head, and to the right iliac fossa, may be advantageously employed, where there are evidences of congestion in the first, or of inflammation, as evinced by pain and tenderness, in the second locality.

Diaphoretics are useful throughout the whole course of the disease.

Of these, the neutral mixture, with tartarized antimony, or sweet spirits of nitre, may be given in the early stages of the disease, and the spiritus mindereri with nitre, in the latter stages. Cold sponging, if it do not chill the patient, is an important remedy, and the internal use of ice is often very grateful. If the patient be very feeble, spirits and water may be substituted for pure water.

d applications to the head, by means of ice in a bladder, are serviceable in relieving the pain and delirium. The hair l also be taken off; and if the head be cold, while delirium is t, Chomel recommends the application of warm poultices. d there be much abdominal tenderness, a few ounces of blood l be taken by leeches, followed by the application of warm tations. If the diarrhœa be profuse, it should be checked ium, either alone or in combination with ipecac., or some gent. Nervous symptoms may be combatted by the use ffman's anodyne, camphor water, or opium, if not contra- ted.

the advanced stage of the disease, when the tongue is dry, the scanty, and the skin parched, and there is delirium, or in- d stupor, with an abatement of the vital actions, no remedy is fectual as mercury, given so as slightly to affect the gums. r blue mass or calomel may be used.

uld the disease not yield, especially if the tongue remain dry, he abdominal distension undiminished, Dr. Wood strongly re- ends the oil of turpentine, particularly in that stage of the e when the tongue, instead of cleaning gradually from the and tip, parts rapidly with its fur, first from the middle or part of its surface, which is left smooth and glossy, as if de- l of its papillæ. It should be given in doses of from five to y drops every hour or two, and its use continued for two or days.

the debility increase, the patient's strength should be supported rdials and stimulants. Beef tea, or beef essence, wine whey, punch, together with the use of quinine, opium, serpentaria, s the exigencies of the case may demand. Sloughing must evented by obviating pressure. Profuse epistaxis by plugging ostrils. And in case of perforation of the intestine recourse be had to large doses of opium.

ne practitioners use quinine throughout the disease. Others upon bleeding, "*coup sur coup*" (Bouillaud). Others upon ng throughout (Delarocque). Professor Mitchell has great ence in the internal use of nitrate of silver, given in doses ⅛ to ¼ of a grain, and increasing it till a metallic film appears the fæcal evacuations. He speaks confidently of its con- ng influence upon the diarrhœa and the nervous symptoms. me it is supposed to act by coming in contact with the ulce- plates of Peyer, upon which it exercises its specific astringent edative influence. Alum has been recommended for the same se.

diet should be mild and unirritating in the early periods of isease, gradually becoming more nutritious as the disease ad- s, and the debility increases. During convalescence it is of extreme importance to guard against an improper diet and fatigue. The debilitated condition, which is apt to remain, is best treated with quinine.

## TYPHUS FEVER.

Syn.—Typhus gravior.—Spotted fever.—Jail, Camp, and Ship fever.—Petechial fever.—Putrid fever.

As the terms *typhus*, *typhous*, and *typhoid* are frequently employed rather vaguely, they require explanation.

The word *typhus* is applied to a specific febrile disease, although the English writers generally do not distinguish between this and the proper *enteric* or *typhoid fever*. The terms *typhous* and *typhoid* signify "a resemblance to typhus fever;" they are applied to other disorders which have assumed a *low* condition; thus we speak of *typhous dysentery*, *typhous pneumonia*, &c.

*Symptoms.*—Before the attack, the patient often exhibits certain premonitory symptoms. He is low-spirited and languid; loses his appetite, and he feels ill without knowing why. There are usually at the same time sharp pains in the head, back, loins, and lower extremities. Violent shivering is often the immediate precursor of the disease; sometimes, however, the cold stage is so slight as scarcely to be noticed.

The febrile condition, when fairly established, is generally well marked. The skin is hot and dry, and of the heat of that pungent, biting character called *calor mordax*. The pulse is full, frequent, and possessed of some degree of strength, but is easily compressed. The tongue is moist, and covered with a yellowish-white fur. Sometimes there is nausea and vomiting. The bowels are costive, and no stools are procured without medicine. The aspect of the patient is peculiar; the countenance is of a dusky hue, with injection of the eyes; the features are fixed and inexpressive, or expressive only of apathy and indifference.

As the disease advances the symptoms augment in violence; the heat of skin increases, the pulse rises in frequency, and diminishes in force, ranging generally from 120 to 150, or 160. The respiration is frequent, and, according to Gerhard, feeble and imperfect at the back and lower part of the chest, which is also dull on percussion. At a period ranging from the fourth to the eighth day, a peculiar eruption appears upon the surface, not confined, however, to any particular locality. It varies in colour from a dusky reddish-brown to purple or black. It is not elevated above the surface, neither does it disappear upon pressure. It is *petechial* in character, and is frequently accompanied with sudamina. The tongue becomes dry, brown, and cracked, and, along with the gums, is covered with sordes; the urine scanty and highly coloured; the dejections, when procured, black and offensive; a peculiar ammoniacal odour is exhaled from the body; the nervous symptoms become more prominent, there is dizziness, confused vision, tinnitus aurium, and sometimes deep stupor, which becomes characteristically more profound as the disease advances. Sometimes violent delirium (typhomania) takes the place of stupor; the patient is sleepless or restless, with the sensation of utter prostration and helplessness. Should no improvement take place the disease passes on to the last stage, that of prostration. The patient lies insensible, or in a muttering delirium, with subsultus tendinum, floccitation, hiccough, involuntary evacuations, and extreme insensibility of the surface, till at length death approaches silently and without violence.

Sometimes a critical discharge takes place from some organ, and the patient begins to convalesce, generally, however, by slow degrees, and under the influence of supporting remedies.

The duration of the disease varies, sometimes, in mild cases, terminating on the seventh day, sometimes running out to six weeks or more. Death rarely occurs before the second week.

*Anatomical characters.*—There is only one constant lesion (and it is questionable whether it can be considered entirely characteristic), viz., the want of coagulability in the blood, and the petechial eruption; all the other lesions may be considered incidental. No disease is discovered in the glands of Peyer, unless in some few cases, in which there is a complication with typhoid fever. A very fatal form of typhus fever prevailed among the black population of Philadelphia, in the fall of 1847. Many died at the onset of the disease. A number of post-mortem examinations were made, but the results were uniform in but few particulars. The blood was fluid and uncoagulated, resembling the settlings from claret wine. Petechiæ were not confined to the skin, but were numerous in the muscles and deep-seated cellular tissue. The skin, fasciæ, muscles, and cartilages, were often turgid with bile. There was great congestion of the liver, lungs, and brain. Thickening of the arachnoid, and effusion beneath it, were common appearances. Another common lesion was, an effusion of blood, in spots of variable size, between the under surface of the dura mater and the outer lamina, or parietal layer, of the arachnoid.

Andral mentions two cases of this kind, and considers them rare. In one it was the result of an injury, and in the other the result of chronic inflammation of the membranes of the brain.

*Complications.*—Pneumonia is most frequent in winter; and dysentery in summer.

*Causes.*—Crowding together a number of persons in badly-ventilated and filthy apartments; the persons so situated are capable of communicating the disease to others, although they may not have it themselves. Contagion is also a cause of this disease, though not a very powerful one where cleanliness and ventilation are duly attended to. Depressing influences of any kind are also capable of producing it. Sex has little influence upon it; it is more common after 35 than before this age, and it is rare in infancy. It prevails at all seasons, and in all climates, though perhaps more in winter, and in the temperate and cold climates.

*Of the nature of the disease* little is known. The probability is, that a poison is absorbed which at once depresses the powers of the nervous system, and vitiates the blood.

*Diagnosis.*—The peculiar hue of the countenance, with suffusion of the eyes; the dark tongue, the sordes upon the teeth, the peculiar eruption, the constipation, the characteristic odour, and the collapse of the last stage, mark the disease. The differential diagnosis between it and typhoid fever, with which it is often confounded, is presented in a tabular form.

DIFFERENTIAL DIAGNOSIS.

| TYPHOID FEVER. | TYPHUS FEVER. |
|---|---|
| Usually endemic; rarely epidemic. | Epidemic usually. |
| Not contagious. | Certainly contagious: may be communicated by those unaffected. |
| Young adults and children most liable. | Spares no age but infants. |
| Age of greatest liability under 25. | Age of greatest liability over 25. |
| Attacks strangers chiefly. | Attacks all residents. |
| Seldom ends before the 21st day. | Ends sometimes by critical discharges from the 7th to the 14th day. |
| Has no well-marked remissions. | Remission after the 3d, 7th, and 14th day generally, and after marked exacerbations. |
| Epistaxis common. | Epistaxis very rare. |
| Diarrhœa a frequent accompaniment; tympanitis. | Costive usually until the 2d or 3d week; abdomen flat. |
| Pulse usually under 100. | Pulse usually over 100. |
| Has a musty smell when the skin is dry; acid, when moist. | Ammoniacal odour, whether the skin is dry or not. |
| Characteristic eruption appears about the 7th or 8th day. | Eruption characteristic, appears earlier, and is more abundant. |
| Sudamina from the 10th to the 15th day. | Sudamina are rare in this disease. |
| Petechiæ are rare in this disease. | Petechiæ and vibices are common. |
| Has a constant anatomical lesion. | Has no constant lesion. |
| Has bronchitis commonly in the second week. | Pneumonia of posterior part of lungs more common. |
| No crisis by sweat, but a gradual recovery. | Crisis by sweating in nearly every recovery. |
| Occurs mostly in the fall and winter. | Occurs mostly in winter and spring. |
| Second attacks are rare. | Second attacks do occur. |

*Treatment.*—A large well-aired room; frequent changes of linen; ablution of the patient's body; removal of all unnecessary carpets and curtains; and the instant removal of all evacuations, are mea-

desirable both to mitigate the patient's disease, and to preven
m infecting his attendants. The chloride of lime may be scat
about the floor.

e treatment of fever, according to the best modern physicians
d be *expectant;* that is, the symptoms should be watched and
ed as they arise, but no violent efforts should be made to cu
isease short. In the first stage, if there is much nausea and
c disturbance, a mild emetic of ipecacuanha may procure relief
owels should be cleared out by an active aperient at the out
say three grains of calomel, with rhubarb, and be kept open b
r doses; viz. hyd. c. cret., followed by castor oil, or an inje
*Mercury,* gently given, so as to touch the gums, has seemed
rvice in some epidemics, but not in others.

e hair should be removed; and the head be bathed with col
s so long as there is much headache, and so long as it is agree
o the patient. If there is *great general heat* of skin, the whol
may be sponged with tepid water.

*oodletting* should never be practised from mere routine, but b
ed to combat any local inflammation that may arise. If th
che is very intense, with great heat, flushed face, and wild de
, a *small* bleeding in the erect posture; or rather a few
s, or the loss of a little blood by cupping from the neck, will
visable. Profound coma should be treated by a large blister
shaven scalp.

eat dyspnœa, with other signs of inflammation in the chest, must
mbatted by a cautious cupping, followed by a blister, or mustard
ice; and small doses of senega.

the type of the fever be very *low,* and there is great feebleness,
l be necessary to give good beef tea, and small quantities of wine
an early period; but this need not hinder the application o
es to combat any local congestion.

e use of *opium* in fever is nearly the same as that of wine.
eneral rule is to give opium, when nervous excitement exceed
lar action, where there is much delirium, and sleeplessness,
a feeble pulse. In some cases it is right to give a good dose a
in others, to feel the way cautiously with small doses. I
cases of excitement, in young subjects, opium may be given i
doses, gr. ¼, with tartar emetic, gr. ⅛. (*Vide* Graves' Clinica
ine.) Opium and wine may be known to do good in fever, i
make the skin and tongue moist, the pulse fuller and slower
they allay nervous excitement, and produce sleep.

state of the bladder should be inquired into every day; and
ed be kept dry and clean. Any spots that seem likely t
te, should be washed with brandy, and protected with soap
r.

onclude: the chief indications in the treatment of typhus and typhoid fever are, to nurse the patient carefully through it; to allay excitement; to prevent local inflammation; and to support the strength.

## RELAPSING FEVER.

This is a disease arising from a specific cause, and characterized by a periodical succession of febrile attacks, alternating with apparently complete convalescence.

*Symptoms, Cause, &c.*—The attack is generally sudden. The patient, previously in health, is seized, on waking in the morning, or while engaged in his daily avocations, with rigors, more or less severe in character. The sense of chilliness soon begins to alternate with flushings of heat; the warmth of skin rapidly increases, and after a longer or shorter interval, the rising fever is accompanied with severe frontal and occipital headache, pain in the back and limbs, and frequent pulse. The tongue is dry, and slightly covered with a milky-looking fur; the bowels are constipated, though occasionally diarrhœa is one of the first symptoms; the urine is high-coloured; the appetite lost, and there is considerable thirst. The respiration is fuller, stronger, and more frequent than usual; the countenance is depressed, sometimes anxious, and the sleep either disturbed, or entirely gone.

With the advance of the fever, the symptoms become aggravated. The skin is dry and hot; the pains in the back and limbs increase in intensity, and the patient now complains of severe, muscular soreness, so severe, indeed, that he resists all attempts to change his position, lest the pain be augmented. The tongue is coated down its middle with a brown fur, while the tip and edges are parched and red. The heat of skin increases until it reaches as high as 100°, and even 107° of Fahrenheit's scale, indicating apparently great inflammatory violence. The heart, by the second or third day, often beats 100, 120, or even 130 strokes in the minute; and what is highly characteristic of the disease, the pulse gradually rises in frequency to 100, 120, 130, 140, 150, and, according to one observer,* 156 in the minute, in adults. The urine becomes scanty and is often voided with difficulty, and the thirst is urgent. Anorexia, nausea, and vomiting of green bile, are among the earliest symptoms. Tenderness at the epigastric region is a constant accompaniment of the disease, and very frequently pressure over the spleen gives evidence of pain and tenderness in that organ.

In the evening a slight exacerbation, succeeded towards morning by the usual remission, is perceptible.

After a period, varying from five to ten days, an unusually severe

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* Dr. D. Smith, Edinburgh Med. and Surg. Journal, for January, 1844.

bation ensues, followed almost immediately by a profuse per-
on, which lasts from 12 to 36 hours. An entire solution of
ver takes place, and the patient in a few hours thinks himsel
tly well. The alteration is most remarkable: in the morning,
ilse may have been 130 in the minute, the skin hot and dry,
ead throbbing; in the afternoon, the pulse is 60, the skin
he head free from pain.

the following day, the patient is apparently, in every respect,
om ailment. His appetite returns, his strength improves, and
ppose him progressing favourably; when, at a period varying
the 12th day to the 20th, reckoning from the outset of the
, or, on about the 7th, counting from the crisis, the patient is
suddenly seized with rigors, vomiting of green fluid and head-
quickly followed by hot skin, rapid pulse, furred tongue, loss of
te, and confined bowels; delirium perhaps supervenes, and, in
ne is in the same state as on the day his illness commenced.
ulse, which falls remarkably during the period of apparent con-
ence, often beating, the day preceding the relapse, as infre-
ly as 48 strokes in the minute, rises suddenly to 120, or even
r. After the expiration of two, three, four, or five days, the
t is again bathed in perspiration, and the next day is conva-
t.

great exacerbation and copious diaphoresis, generally occur, in
st paroxysm, on the fifth day; sometimes on the seventh, and
ery few cases on the ninth day.

second paroxysm of this disease, though of shorter duration
he first, is characterized by the greater severity of its symp-
and is, moreover, accompanied either by diarrhœa, or dysen-
f a severe and troublesome nature.

metimes the patient suffers a third such attack, and even a
, fifth, sixth, and seventh have been observed. This protrac-
f the disease is, however, of very rare occurrence. The third
ysm generally proves fatal.

*nplications.*—The most common complication is gastric irrita-
This symptom, in some instances, amounts to little mor
nausea, retching or slight vomiting, with occasional tenderne
epigastrium; but at other times, the nausea and vomiting ar
ive and constant, continuing for several days, when eithe
ine or drink is swallowed; and pressure over the stomach i
able. At first, the egesta are merely the fluids taken t
he thirst; but as the vomiting continues, bile and even bloo
e detected; and finally, black-vomit.

ther complication, and one peculiar to this fever, is jaundice.
erally makes its appearance about the third or fourth day;
mes reaching its fullest point in a few hours, and at other
advancing gradually. It lasts from one day to a couple of

weeks, and does not seem to interfere with the progress of the fever. However produced, it is certainly not dependent upon any obstruction or congestion of the biliary apparatus, inasmuch as the stools, during its continuance, retain their natural hue, or are darker than common; at the same time the urine is frequently loaded with bile. Moreover, post-mortem examinations show that the ductus communis allows bile to pass freely into the duodenum; even in those cases in which jaundice was present at the time of death.

Catarrhal symptoms are common during the winter, and among children. Pneumonia and pleurisy occasionally accompany the relapse.

Petechiæ are now and then present; and an eruption is sometimes seen resembling flea-bites somewhat, but differing from them and from the tache rouge of typhoid fever, by being flatter and disappearing more readily under pressure.

Comatose symptoms sometimes supervene in old people, in whom there is suppression of the urine.

More or less violent delirium is now and then observed, after the critical discharge.

*Anatomical characters.*—No anatomical character of this disease has been pointed out. The most constant lesion by far is enlargement of the spleen. In the substance of this organ are found pale yellowish-pink masses of variable size, firm to the touch, but friable, with a slight granular fracture. A slight excess of serosity is occasionally found beneath the arachnoid membrane of the brain, and in the lateral ventricles. The blood, which, in a few cases, has been found fluid throughout the body, is generally buffy from the beginning. The liver is generally large, and the gall-bladder contains a considerable quantity of thick dark bile.

*Cause, mortality, &c.*—Of the cause of this fever little or nothing is positively known in the present state of our knowledge. It seems to be dependent on some specific poison, and according to the majority of observers, is contagious in its character.

The greatest mortality in any epidemic did not exceed 12 per cent. The ordinary mortality is from 3½ to 4 per cent.

A large majority of the pregnant women attacked by relapsing fever abort; and this accident is not unfrequently followed by death.

No particular day has been observed on which death from this fever takes place. When the fatal event was about to occur, the patient seemed to sink into a state of lethargy or coma, from which they could be easily aroused, and would answer questions put to them with considerable correctness.

*Diagnosis.*—The rigors, vomiting, and pain in the back, might lead one to suppose the patient to be labouring under small-pox; but the pain in the back is rarely so severe, nor is the vomiting so

ant, as it ordinarily is in the early period of the last-named
e. The suddenness of the attack, the rigors, hot skin, pain
limbs, and white tongue, distinguish relapsing fever from
thic head affections. The heat of skin, the quick pulse, the
iolent headache, which is commonly frontal, serve to distin-
this fever from the ordinary bilious and remittent fevers.
er the mulberry rash of typhus, nor the rose spots of typhoid
are ever present in relapsing fever.

*atment.*—Owing to the limited experience of the profession
is disease, much uncertainty exists as to its efficient treat-

it cannot be cut short, and as it naturally tends to a resolution
the fifth day, venesection is discountenanced by the majority
ervers. If acute inflammatory complications exist, however,
must be had to bloodletting, and the case treated on general
hlogistic principles. Where the violence of the disease appears
l upon the spleen and the stomach, as is shown by the enlarge-
of the former, and the great irritation of the latter organ,
over the splenic, and leeches to the epigastric regions, are
y serviceable, and should be repeated until the symptoms
to abate.

ring the chill, warmth to the skin,—either by sinapisms, fric-
&c.,—is indicated to counteract visceral congestion, by giving
ty to the cutaneous capillaries.

phoretics judiciously exhibited, prove eminently useful in
the natural tendency to a crisis by sweating, and the tem-
y resolution of the fever.

thing is so useful in alleviating the great muscular pain and
ess of which the patient complains, as the hot infusion of
set,—the Eupatorium Perfoliatum of the U. S. Pharmaco-

relieve the excessive pain in the head, resort may be had to
applications, cups, leeches, &c. Sinapisms to the back will
serve materially in dissipating the intense lumbar pains which
atly annoy the patient.

the reproduction of the attack in this disease seems to depend,
intermittent fever, upon the enlarged and congested spleen,
ttempt should be made during the intermission, to relieve
rgan and reduce its size by means of mercurials, iodide of
ium, quinia, &c.

excessive debility, with which convalescence from this fever
erally attended, renders the early use of stimulants and tonics
tely necessary to prevent the sinking of the powers of life.*

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above description and treatment of relapsing fever are condensed from various
eriodicals, and from manuscript notes of Professor Mitchell's lectures in Jefferson
College.

## VARIOLA, OR SMALL-POX.

This is a contagious disease, characterized by an initial fever of three or four days' duration, and followed by a peculiar eruption, which is at first papular, then vesicular, and ultimately pustular.

The disease was unknown to the ancients. It first appeared in Europe about the time of Mahomed.

Two varieties are commonly noticed—the *distinct* and the *confluent*. In the former, the pustules are completely isolated; in the latter, they run together, and are generally more abundant.

Three stages occur in the disease;—1, the initial or eruptive stage; 2, the maturative stage, commencing when the eruption is fully out; 3, the period of decline. Some consider the period which elapses between the inception of the poison and the attack of fever as a distinct stage of the disease, and enumerate the following stages:—1st, Incubation, from six to twenty days; 2d, Invasion; 3d, Eruption; 4th, Maturation; 5th, Decline; 6th, Desquamation.

*Symptoms.*—The ordinary symptoms of fever, with increased pain in the back, and irritability of stomach, amounting often to obstinate vomiting; coryza and sore throat are frequently present; and in children, convulsions. The fever is of the remittent type, and subsides very decidedly on the appearance of the eruption, which, in the distinct variety, comes out usually in the course of the third day,—at first as minute red papules over the face, neck, chest, and abdomen, and finally over the lower extremities. It is generally completed in about two days. Now commences the *second stage*, when the eruption is fully out, and begins to undergo change, on the different parts of the body, in the order in which it first appeared. The pimples are converted into vesicles on the second or third day of the eruption, and become *umbilicated*, or depressed at the summit, on the fourth. From this time, they gradually increase in size, the lymph becoming opaque, until the vesicle has changed into a pustule. About the fifth day of the eruption, they lose their umbilicated appearance, and become convex and distended at the top, and about the *eighth* day of the eruption, or the eleventh or twelfth of the disease, they commence to turn of a brownish colour, sometimes to burst, and to dry up.

The *quantity* of the eruption varies from a few scattered pustules to a complete efflorescence over the whole body, the *isolated* character being, however, always maintained in the distinct variety. During the eruptive stage, the different mucous membranes become likewise affected, hence the pain in the throat, sore eyes, and coryza. The *skin* is apt to become swollen, especially on the face and head, during the filling and maturation of the pustules.

The *secondary fever*, or *fever of maturation*, comes on about the

or twelfth day of the disease, or the sixth or eighth day of the
on: it depends on the sympathy of the constitution with the
ffection, and it is proportionally severe according to the in-
y of the latter. During the period of maturation a peculia
odour is given off from the patient's body, by which the dis-
nay be recognised; violent itching also accompanies thi

*third* or *declining stage* commences about the twelfth day o
sease. Some of the pustules dry up; others burst, pourin
heir contents, which dry in the form of brownish scabs.
process of desiccation continues, and is generally completed b
fteenth to the twentieth day, after which, circular brownish-re
remain often for several weeks, together with the characteristi

*confluent variola*, all the symptoms are of a more grave type.
erebral and gastric complications are more intense, there bein
tent vomiting, and either delirium or convulsions. Thes
ions may cause the death of the patient before the appearanc
eruption. The eruption, which is commonly *simultaneous*,
eldom *successive*, occurs about the *second* or *third day*, rarel
fourth, and still more rarely on the fifth. It is sometime
npanied by a rash resembling scarlatina or erysipelas.
e pustules are less prominent, and more aggregated, than i
e variola, and their edges run into one another. They d
however, fill so completely as in the distinct form, and ar
r and darker in colour. They are more numerous on the fac
other parts; and in fact, when crusts begin to form, the whol
s covered, as it were, with a mask. This incrustation falls o
about the fifteenth to the twentieth day. The fever neve
ly subsides, as in the distinct form; it is much aggravate
g the second or maturative stage, and although generally o
thenic character, it sometimes assumes a low tendency, an
atient may die from extreme exhaustion. By some writers
reater intensity of the secondary fever is considered as diag
of this variety. The eruption usually begins to scab upo
ce, about the tenth day of the disease. The skin here is ex
ely swollen; matter oozes out beneath the crusts, and is min
with a bloody and ichorous discharge. The mucous membrane
greatly, especially those of the throat, larynx, nose, and eyes
ould the patient survive the second stage, and pass into th
of decline, he is still exposed to danger from pseudo-membra
inflammation of the larynx and fauces, pneumonia, pleurisy
ctive ophthalmia, sloughing or ulceration of the cornea an
quent permanent opacity of this structure, excessive suppura
erysipelas, and gangrene. After desiccation unsightly scar
its are usually left behind.

ıe condition called *malignant small-pox*, there is either a ;e prostration of the nervous power from the very first, so ; patient never reacts from the onset of the disease, or there ›raved condition of the blood, giving rise to petechiæ and and accompanied with other evidences of a typhous state. ;enerally occurs in such cases from the seventh to the ninth the disease.

during the secondary fever, which is very violent in the con- mall pox, that most danger is to be apprehended. Out of aths, recorded by Dr. Gregory, 27 occurred on the eighth the eruption (eleventh day of the disease). Thirty-two died first week, 97 in the second, and 21 in the third. In the ak death seems to be caused by an overwhelming malignancy oison, oppressing the brain, and causing coma; in the second rom affections of the respiratory passages; and in the third ›bility.

*nosis.*—The distinct variety usually recovers under proper nt; the confluent is extremely dangerous, and the malignant necessarily fatal.

*e.*—A specific contagion. All are liable to be attacked un- eviously protected. Epidemic influences appear to give energy to the specific cause, but they cannot *originate* the

*tment.*—Under the old stimulating and heating plan of treat- mall-pox was a very fatal disorder. At present, it is much anageable under the *refrigerant* plan. The room should be ool, and well-ventilated. In mild cases, the only medicines l are refrigerant diaphoretics, and an occasional laxative. In cases a saline or mercurial cathartic may be given at first, l by the other measures above recommended. Occasional g with cool or tepid water if the skin be very hot and dry. nportant to recollect that the disease cannot be cut short, he strength of the patient should be husbanded. Dover's may be given at night to combat the restlessness. *Bleeding* · required, except to counteract some intercurrent inflamma- ıd, in such cases, local bleeding would be preferable. After ; stage very little is required; perhaps the nervous symptoms l for the use of Hoffman's anodyne, or sweet spirits of nitre. ıe confluent small-pox, the treatment is often not so simple; uires to be varied to meet the symptoms that arise, just as r. Great restlessness, wakefulness, and delirium, about the ır ninth day, are generally benefitted by opiates. If the pulse e, broths and wine are required; especially if the pustules fill out.

ıg the *secondary fever*, which generally sets in about the

th day of the disease, aperients, opiates, tonics, and nourish-
et should be given.

at dyspnœa requires a blister to the chest.

intolerable itching is best allayed by smearing the eruption
old cream.

rious measures have been proposed, in order to prevent the
and disfigurement occasioned by this horrid disease. Pen-
the pustules with lunar caustic, and with tincture of iodine;
ng each of them; covering the face and hands with an oint-
composed of litharge and mercurial ointment; keeping the
t in perfect darkness, have each been recommended; but with
oubtful success. They should all be tried before the eruption
nes vesicular.

*evention of Small-pox.*—There are two methods—*inoculation*
*accination.* The first is very effectual, because it actually im-
the disease in a mild form; but it is not unattended with
r, especially from multiplying *centres of contagion.* The other
od, termed vaccination, is now universally practised.

CCINA, the *vaccine disease*, or *cow-pox*, is the name given to a
se attended with umbilicated vesicles, produced by inoculation,
rotecting the human system from small-pox. To Dr. Jenner
the credit of first bringing into practice this artificial mode of
cting the system. The disease was noticed first in the cow
nce its name), in which animal it appears in the form of small
es upon the teats. The matter taken from such vesicles is
ctive.

e idea at present entertained is, that this disease is variola
fied and rendered milder by passing through the system of the
and confirmatory of this view, is the experiment of inoculating
ow with variolous matter, and then employing some of the
r from the resulting pock;—it was found to be protective.

*mptoms, Course, &c.*—A very slight inflammation at the poin
ncture is seen, which soon, however, disappears. On the thir
a little red speck, slightly elevated, is noticed, which has be
a vesicle by the end of the fourth day. On the fifth, it i
ly umbilicated, and contains a clear lymph. This graduall
ges, and on the sixth day the areola is visible; this continue
large until the tenth day, when the disease is at its height
the pock is about one-third of an inch in diameter, elevated
licated, and exhibiting a minute scab upon the surface. Th
is usually two inches or more in diameter. The scab now
ally forms, the serous liquid is replaced by pus, and about the
y-first day the scab separates, leaving a cicatrix of a peculia
rance.

constitutional symptoms, if they occur at all, appear about the eighth to the tenth day. Sometimes there is a little fever, and swelling of the axillary glands, and occasionally a slight eruption.

There is great difference in the susceptibility of persons to the vaccine disease, also, in the same person, at different times.

In relation to the degree of protection afforded by vaccination, it would appear, as the result of numerous experiments, that about *one-half* the vaccinated are liable to a modified form of small-pox, or varioloid, on exposure. Still, cases of varioloid, are so rarely fatal, that it may be considered as almost certainly protective, so far as danger is concerned. Some suppose that the protective influence gradually wears out from the system, and requires renewal. This idea is incorrect; for in that case, the susceptibility to varioloid ought gradually to increase, the longer the interval from the period of vaccination; whereas, the susceptibility really diminishes after the twenty-fifth year. The truth appears to be, that the original amount of protection afforded by vaccination, differs in different cases; and that there is the greatest susceptibility to varioloid between the ages of 15 and 25 years. Hence, *revaccination* should always be practised *within these years;* or, if not then, certainly at the commencement of any variolous epidemic.

## VARIOLOID.

This name is applied to a modified form of small-pox, occurring in persons protected by the influence of vaccination. As already remarked, the complete protection of vaccination extends only to about one-half of those subjected to it.

There is no reason for regarding varioloid as a distinct disease. The proofs of its identity with small-pox, are the facts that it varies much in its intensity, that it is produced by the same cause—contagion; and that it is capable of producing genuine small-pox in the unprotected. In some cases, the fever alone exists; in others, only an eruption, either papular or vesicular, and most commonly in part pustular, going on to the fourth or fifth day, and then drying up. Its progress is always shorter, by several days, than variola, and it is destitute of the characteristic odour of that disease.

The *treatment* is the same as for mild cases of variola.

## VARICELLA, OR CHICKEN-POX.

This is a contagious eruptive fever,—the eruption being vesicular.

*Symptoms.*—Occasionally febrile symptoms may be present, but generally they are very slight, and continue from a few hours to two days, when they disappear on the occurrence of the eruption. This comes out in small red spots, which speedily become vesicular, and are often accompanied with itching. They attain maturity about fth day, having become puruloid. They then commence to ate, the crusts falling off on the ninth or tenth day. The are usually few in number, and very seldom umbilicated.

only known *cause* is a specific contagion. It sometimes epidemically. One attack is protective against a second one. only disease with which it can be confounded is small-pox.

*atment.*—Often, nothing is required. The mildest antiphlo- means are sufficient.

## RUBEOLA (*Measles*).

s is a contagious fever, accompanied with a peculiar eruption.

*mptoms.*—Those of an ordinary fever, with the addition of of catarrh, such as redness and watery appearance of the eye, a, with frequent sneezing, hoarseness, and cough. There may e some dyspnœa and tightness of the chest. The eruption s its appearance on the *fourth* day, in the form of small cir- spots, first on the face, and extending itself successively within or two, to the neck, chest, and limbs. In general, the small are succeeded by larger ones, and the final arrangement of the es is usually in a *semicircular* or *crescentic* form. The red f the eruption assumes its greatest intensity on the face on *fth* day.

e fever does not subside on the appearance of the eruption; it even be increased, as also may be the catarrhal symptoms. ruption is slightly elevated above the skin, and is attended with itching, when at its height. There may also be a few æ or vesicles interspersed along with the regular eruption.

hen the eruption is fully developed, the frequency of the pulse, thirst, redness of the eyes, and coryza disappear, or are much ated; the nausea and vomiting also subside. About the sixth he watchfulness disappears, the cough and dyspnœa being the symptoms that remain. On the third or fourth day of the ion, the spots become pale, and gradually assume a yellow and when the redness has disappeared, the epidermis becomes hed in small furfuraceous scales.

children with a delicate skin, the eruption sometimes appears e third day; but in those with a thick, brown skin, it may not veloped before the fifth day.

some cases there is no catarrh; the disease is then named *ola sine Catarrho* or *French measles*. Again, there may be y a fever with catarrh but without the eruption. These forms disease are not certainly protective.

measles, the mucous membranes are very apt to be affected; lly, the membrane of the trachea, bronchi, fauces, nostrils, elids, is principally affected, but sometimes that of the stomach or bowels principally suffers, producing nausea, vomiting, or purging. At other times, the membranes of the brain are implicated, inducing convulsions, stupor, or coma. It usually gets well in uncomplicated cases.

The *prognosis* is unfavourable when the child is very young, when the eruption appears before the third day, or when it suddenly disappears. A leaden hue of the spots, petechiæ, or excessive dyspnœa, are also unfavourable signs. The prognosis is favourable when the gastro-pulmonary symptoms are slight, the progress of the disease is regular, and when the skin is moist after the appearance of the exanthema.

The *sequelæ* of rubeola are bronchitis, pneumonia, pleuritis, cæcocolitis, diarrhœa, and ophthalmia. The chief danger arises from the complication with pneumonia.

*Causes.*—A specific contagion. It is said to be imparted by *inoculation.* Epidemic influences also operate in its production.

*Treatment.*—When the gastro-pulmonary symptoms are slight, the treatment merely consists in keeping the patient in a mild temperature, on spare diet, and giving gentle laxative and diaphoretic medicines. If the soreness of the throat be very troublesome, the inhalation of the vapour of warm water is useful.

As a general rule, all inflammations that precede, accompany, or follow rubeola, when severe, should be treated as though that exanthema was not present. Should pneumonia, or laryngitis, set in, the treatment according to the above rule should be on the general principles laid down for the removal or alleviation of these affections. If the eruption disappears suddenly, the treatment must depend upon the cause producing this effect. If it is induced by the sudden development or increase of an internal inflammation, the attention must necessarily be directed to the immediate subduing of the inflammatory action. If the recession depends on cold, the warm or vapour bath should be had recourse to. Diarrhœa frequently comes on during the convalescence, and if not too severe, is useful in checking a tendency to thoracic disease; should it, however, proceed too far, small doses of Dover's powder, and the occasional use of the warm bath, will be found useful. A common sequela of measles is, a short, hoarse, and barking cough, which has a great deal of the croupy sound, but is not attended with dyspnœa. It readily yields to counter-irritants. During convalescence, exposure to cold should be guarded against. The *malignant* form is treated with stimulants both internal and external.

## SCARLATINA.

This is a contagious, eruptive fever, particularly affecting the skin and mucous membrane of the throat. About the second day of the on, the whole surface of the body presents little red points, are soon followed by patches of a deep scarlet colour, serrated ir edges, which become confluent, and terminate by desqua- n from the fifth to the ninth day. The rash is slightly elevated the skin, and disappears on pressure.

rlatina occurs under three forms—*Scarlatina simplex*, *S. an-* , and *S. maligna*.

### SCARLATINA SIMPLEX.

precursory symptoms of this form are, general debility, n, shiverings, followed by flushes of heat and thirst. On the day of the febrile symptoms, little points, at first of a light hen becoming deeper, appear in great numbers on the face, and chest. In the course of twenty-four hours, similar spots r on the body, lips, tongue, palate, and pharynx. On the day, most of the interstices which had been left are covered large dotted patches, having serrated edges. In this stage the is full and very frequent, the tongue is covered with a creamy through which the red and elevated papillæ appear, producing racteristic appearance of the organ. The skin is much hotter s form of exanthema than in any other. The scarlet colour is eeper tint on the groins, buttocks, and folds of the joints, than er situations.

out the *fifth* day, the interstices between the patches become , the scarlet colour less vivid, and slight desquamation takes on the neck, temples, and chest. On the *sixth* day, the cha- of the disease becomes less distinct; and on the *eighth* and days, desquamation from the surface of the hands, feet, and ifferent regions of the body, takes place.

### SCARLATINA ANGINOSA.

*mptoms.*—This form is characterized by the accompanying mation of the throat; it commences with more intense fever, sense of stiffness of the neck and inferior maxilla. On the day, the pharynx is inflamed, deglutition is difficult, the amyg- become swollen, and the mucous membrane presents a vivid red rance. In the S. simplex, the pharynx presents an exanthe- s blush, but there is no effusion; in this form, however, a ity of thick, viscid fluid, sometimes of a whitish-yellow colour, ore generally, caseous-like matter, is thrown out on the amyg- pharynx, and anterior pillars of the velum. During the second, and fourth days, symptoms of gastro-enteritis are present; ngue is of a bright red colour; there is nausea, vomiting, œa, or constipation, dry cough, quick and vibrating pulse, and onally epistaxis. The eruption, which appears on the *third* s not so generally or equally distributed as in the former affection. It also sometimes disappears suddenly, frequently on the day after its appearance, and returns again after an uncertain period of time. The entire duration of this form is longer than in simple scarlet fever, and its order of appearance, and that of its desquamation, are not so regular. It is much more dangerous.

### SCARLATINA MALIGNA—MALIGNANT, OR PUTRID SORE THROAT.

*Symptoms.* — This form comes on like the scarlatina anginosa, except that the symptoms are of a graver type even on the first accession. Sometimes, in fact, the patient is stricken dead by the poison in a very few hours before any eruption or local symptoms come on. The throat affection is however usually very prominent. The eruption does not present a scarlet appearance, but is more of a livid hue, and frequently interspersed with petechiæ. It is irregular in its first appearance, and it may disappear and reappear several times. In this form of scarlatina the pulse is small and irregular, the teeth and tongue are covered with brown or black incrustations, the eyes are much injected, and the vision is confused; the respiration is laborious, and the breath is fœtid; the pharynx is covered with thick, viscid mucosity, and there is often sloughing of the surface of the amygdalæ. Convulsions and coma are frequent concomitants of this affection in children, while delirium and deafness attend this form in the adult.

The appearance of numerous petechiæ, of abundant diarrhœa, of difficult respiration, or of persistent coma, announce the approach of death.

The *sequelæ* of *scarlatina* are, anasarca, ophthalmia, otitis, bronchitis, enteritis, orchitis, and tonsillitis, in adults; abscesses of the sub-maxillary and parotid glands, &c., in children.

*Treatment.* — In *scarlatina simplex*, when the bowels are constipated, mild purges may be employed. Rest in bed, spare diet, cooling acidulous drinks, and, where the surface of the body is extremely hot and burning, cold sponging, are the means principally to be relied on. A mild emetic given at the onset, is thought to modify it.

In *scarlatina anginosa* and *maligna*, the treatment must be varied to meet the symptoms. If there is violent cerebral excitement, leeches or cups may be applied; but if the powers of life are low, it may be necessary to give wine, beef-tea, &c., from the very commencement. The *throat* always requires great attention. The patient, if able, should use a gargle containing muriatic acid, or chloride of soda, and should inhale the steam of vinegar and water.

The best gargle is one made by infusing an ounce of red pepper in a pint of boiling vinegar and water. In cases of young children, it may be applied by means of a swab. The bowels should be regularly cleared by mild aperients and enemata. The citrate of potassa, given in a state of effervescence, is an excellent medicine in most cases. Cool sponging is of service when the heat of the surface is steadily high; but in malignant cases it is to stimulants that the practitioner has chiefly to look for the safety of his patient.

The internal and external use of chlorine throughout this disease is highly recommended by some authors. It may be used either in the form of the aq. chlorinii f℥ss, aquæ font. f℥viij, and syrup. f℥j; a tablespoonful of the mixture being given every hour or two, or it may be given in the form of a solution of chlorate of potassa, in the proportion of a drachm to a pint of water, and used *ad libitum.* It may also be used as a gargle to the throat. When pseudo-membranous or gangrenous patches are observed in the fauces, and the colour of the membrane is dark-red, an infusion of capsicum is an excellent application. The sulphate of zinc, or nitrate of silver, is also useful under similar circumstances. When the sloughs are offensive, the fœtor may be often corrected by a creasote gargle, or a gargle of pyroligneous acid in solution.

Fomentations and poultices may be applied to the throat; leeches are usually of no benefit.

*Belladonna* is sometimes used as a preventive. It may be given in a solution made by dissolving three grains of the extract in a fluidounce of distilled water, of which three drops is the dose for a child under one year, increasing it one drop for every year.

During convalescence, the patient should be protected from cold, and ought occasionally to employ tepid baths, and frictions to the surface.

## ERYSIPELAS.

This is an exanthematous fever affecting the skin or the subcutaneous cellular tissue, or both. It arises from a peculiar poison, and is not contagious. It is sometimes merely a local disease depending upon some local injury.

There are two chief varieties of it:—the *simple*, which affects the skin, and ends in vesication and œdema; the *phlegmonous*, which affects the subcutaneous cellular tissue likewise, and causes unhealthy suppuration and sloughing.

### SIMPLE ERYSIPELAS.

Erysipelas always begins with shivering, nausea, and other signs of fever, and derangement of the stomach. The skin of the part affected becomes slightly swollen, and of a red colour; there is acute pain, with a sensation of burning heat, but no throbbing, as in phlegmon. The redness disappears on the slightest pressure, and reappears immediately on its removal. It is very apt to commence on the side of the nose, or ear, and it has a definite boundary.

In some instances, small miliary vesicles appear, in others bullæ or phlyctenæ are observed. The most favourable termination is in resolution, in which case the epidermis is thrown off in small scales. It occasionally assumes an *erratic* form, and sometimes it terminates by *metastasis* to some of the internal organs.

*Phlegmonous erysipelas.*—In this form the redness is very vivid, and diminishes in intensity from the centre to the circumference. The cellular tissue being implicated in this affection, produces swelling, hardness, and a burning pain. This affection may terminate in resolution; but should it proceed to suppuration, and measures are not employed to allow of the exit of the pus, abscesses will form, and the cellular tissue between the muscles will become implicated. The abscesses and sinuses thus formed, will gradually burst externally, when a quantity of gangrenous masses, mixed with fœtid pus, will be discharged. The constitutional symptoms in this case indicate that much mischief is going on. The pulse becomes quick and hard, and the tongue brown; encephalitis, meningitis, or gastro-enteritis, may come on, and the patient sinks under diarrhœa, with low muttering delirium and coma.

*Œdematous erysipelas.*—This is the name given to *simple erysipelas* affecting loose cellular parts. The skin is smooth and shining; and pits on pressure. This affection often induces gangrene, the skin being deprived of its supply of blood through the distension of the cellular tissue; the accession of this is announced by acute pain, a red and shining skin, with sometimes a livid or leaden hue. The genitals in women, the scrotum in men, and the infiltrated limbs of hydropic patients, are the most usual seats of the œdematous erysipelas.

*Erysipelas of the head and face* is generally of the simple or œdematous variety; and is the form which the disease assumes, when there is no wounded part for it to fix upon. It is very dangerous, as the contiguous irritation is liable to cause inflammatory excitement, or effusion within the cranium.

Erysipelas is usually of a sthenic character; but in certain epidemic conditions, it may assume a malignant form. The disease termed *black tongue* is probably a malignant form of erysipelas, without an eruption.

*Treatment.*—When the surface of the inflamed part is of a deep or florid red, tense, and very hot; the pulse hard, full, or strong; the head much affected, general *bloodletting* may be requisite, especially in unbroken constitutions, in persons not addicted to drinking to excess, and very early in the disease. Leeches cannot be used, because the punctures may take on the erysipelatous inflammation.

At the outset, an *emetic* may often be administered with advantage; and in the severer cases calomel together with the refrigerant diaphoretics.

ter depletion, Dover's powder is useful at night. If the e continue after the first week, it will be proper to use *ry*, along with opium and ipecac., so as gently to affect the n.

malignant and gangrenous cases, stimulants and tonics, espe- Peruvian bark, are indicated.

*al treatment.*—At first employ cold mucilages; and if disposed end itself, use tincture of iodine, or a strong solution of nitrate ver, to circumscribe the disease.

en the functions of the different secerning and excerning s have been properly restored, *tonics* and *alteratives* should be yed; of the former class, the preparations of cinchona are most recommended.

the *phlegmonous* form, *free incisions* should be employed , before the matter burrows deep, and causes much constitu- l irritation. Permanent and diffusible stimuli should be used, f there is much restlessness, opium should be exhibited, unless is a tendency to coma. Free incisions, followed by poultices, he most efficient means in this case, as they tend not only t of the escape of matter, which acts as a foreign body in the n, but also to relieve the tension of the parts, and to destro nflammatory orgasm in them. Bleeding from the incision d be carefully watched, as it is sometimes profuse; and it may, ncontrolled, or unaccompanied by a sufficiently restorativ nent, especially in drunkards and those of broken-down con- ions, be attended by dangerous consequences. If the affec- as been neglected until sloughing has occurred, before incisions been made, lint dipped in oil of turpentine, or in equal part nd Peruvian balsam, should be applied, and covered by warm ices.

## RHEUMATISM.

some pathologists this is considered only as common inflam- n attacking the fibrous tissues, and deriving its peculiaritie the tissue involved. There is reason, however, to believe tha eculiar in its character, and that any tissue of the body ma acked.

ur varieties are noticed,—the acute, subacute, chronic, and us.

*ute Rheumatism.*—This variety usually attacks the large . There is considerable fever, either commencing with o ollowing the local inflammation. Sometimes a single joint i t affected, others following in succession; at other times l joints are simultaneously involved. Other tissues may als cked, as the muscular, areolar, and dermoid. The fever i sthenic character. Pulse full and strong, the tongue thickl furred; excessive pain in the joints, much increased by the slightest pressure or motion. There is also a copious acid perspiration. It is very apt to shift from one joint to another, and especially to fix upon the heart or pericardium, causing endocarditis and pericarditis, of which the occurrence of *delirium* is usually a significant warning. Occasionally the fever is adynamic. The blood when drawn exhibits decided increase of fibrin, which often amounts to ten parts in a thousand.

*Causes.*—The most frequent is exposure to cold and damp, after free perspiration, especially in persons constitutionally predisposed. It is rare before the eighth year of age, and seldom occurs in the aged. It is also hereditary.

*Prognosis.*—When properly treated, it usually gets well. The chief danger is from the complication of the heart disease; but this also generally yields to active treatment. In children under fourteen years, it is a dangerous affection.

*Subacute Rheumatism.*—This variety is very common; it occurs usually in the muscles, though it may also attack the joints, involving either the synovial membrane, or the surrounding ligaments. The pain is often severe; but there are much less fever and swelling than in the acute form. In muscles it causes pain in movements; in the mucous membrane of the bowels, it produces diarrhœa; in the bronchial tubes, catarrhal symptoms, &c.

It receives various names,—as *torticollis*, when it affects the muscles of the neck; *pleurodynia*, when it is seated in the muscles of respiration; *lumbago*, when in the muscles of the back; *sciatica*, when in the neurilemma of the sciatic nerve; *hemicrania*, when located in the scalp. When in the muscular coat of the bowels, it produces colicky symptoms. It is apt to seize upon the heart, where it is the source of great danger, and often causes sudden death, from its inability to contract. Probably many cases of supposed angina pectoris are referable to this cause. It is, moreover, a more common cause of organic disease of the heart, than the acute form. It also attacks the diaphragm and the uterus,—in the latter case, giving rise to dysmenorrhœa. It may last many months, and often resembles neuralgia.

*Causes.*—Similar to the acute, but dependent upon a difference in the constitution; there may be less plastic matter in the blood. It is dangerous only when it attacks some vital organ, as the brain or heart.

*Chronic Rheumatism.*—This form is most apt to fix upon the joints and synovial membranes. There is no fever nor heat, but little redness, and only an obscure dull pain, usually worse at night and in damp cold weather. The joints are apt to become permanently swollen and stiffened. It may last a lifetime, and is either the result of the acute form, or is produced by the same cause, only modified by the constitution.

*vous Rheumatism* is that form of the disease in which the se
or function is only affected, without inflammation; it is anal
o nervous gout.

*ture of Rheumatism.*—It is not well understood. The infla
1 is certainly *peculiar*, since it rarely or never suppurates, an
ces a disposition to metastasis. Some ascribe it to an exce
l.

*atment.*—In the *acute* variety, bleeding is well borne, but
t cure it. Be cautious about too much bleeding, lest the
t up a tendency to irritation in certain important organ
thus become centres of attraction for the rheumatism. Acti
ng is always proper; it may have to be repeated in a few day
bowels be kept steadily open by sulphate of magnesia a
drops of wine of colchicum.

frigerant diaphoretics are indicated, and Dover's powder,
ose, is to be given at bedtime.

it does not yield by the second week, resort to *mercury*, whi
properly be combined with opium. Colchicum and morph
d be used, if it is disposed to move about. If attended wi
mia (as indicated by perspiration during sleep), *quinia* is
able remedy in doses of twelve to twenty-four grains duri
venty-four hours. *Excessive* doses are dangerous, as causing
ncy to the brain.

ould it be complicated with cardiac affections, bleed general
ocally, blister, and commence the mercurial course *at once.*
rain is involved, the treatment is the same. The adynam
requires stimulants.

*mon juice* has been lately highly recommended. Other pla
been practised, as repeated bleedings, *coup sur coup;* ve
doses of tartar emetic, or of nitre, excessive doses of opiu
Prof. J. K. Mitchell, who regards this as a disease of *spin*
, has had much success in the acute form by the applicati
ps to the spine, in the neighbourhood of the affected part.

regards the *local treatment*, there is risk of repelling it fro
oints to the internal organs, by the use of powerful remedi
ld, &c. The part may be covered up in carded cotton
el, or a hop poultice, or mild anodyne liniment applied.

the *subacute* form local bleeding is often beneficial, as cups
ago or pleurodynia. The bowels should be kept free wi
amore's mixture. Dover's powder, tincture of aconite root
of five drops every four hours, warm baths, and, if persiste
onstitutional impression of mercury should be employed. Lo
lies must be used with caution, from the danger of repellin
rs are hazardous. Persons liable to this variety of the disea
d take at the onset a dose of Epsom salts, with morphia a
cum.

In the *chronic* form, bleeding is rarely employed; cups and leeches are often of use; moderate purging, and then laxatives, as sulphur, &c.; the hot bath (especially the sulphur springs), revulsion, Dover's powder at night, iodide of potassium, or iodine in other forms, extr. of belladonna, conium and stramonium, sarsaparilla, guaiacum, &c. A mild and continued course of mercury will often clear it out entirely. A long journey, or a sea-voyage, often proves decidedly beneficial. The chief *local* measures are, blisters, repeated, and other revulsives, frictions, and tincture of iodine.

## GOUT.

A constitutional disease analogous to rheumatism, characterized by an excess of uric acid in the system, which is separated from the urine, and, occasionally, is deposited in the joints in the form of *chalk-stones* (urate of soda).

Three varieties are noticed;—the acute, chronic, and nervous.

*Acute Gout* occurs in persons of vigorous constitution, and in adults. It is occasionally preceded by some febrile symptoms, but usually the attack is sudden in the night, the patient being seized with an acute tearing pain, mostly in the ball of the great toe, together with some of the smaller joints of the feet.

The ordinary signs of inflammation are present, as heat, swelling, redness of a bright tint, and exquisite tenderness, together with turgescence of the neighbouring superficial veins. In about eight or ten hours these symptoms all abate except the swelling, which becomes œdematous. The fever usually remits with the decline of the other symptoms, but the paroxysm returns towards the next evening; and so it is apt to do for about a week, when it goes off with copious perspiration, lateritious urine, or diarrhœa. The cuticle of the inflamed part desquamates with excessive itching.

After the fit is over, the patient feels better in his health than he had done for some time before. But without great care, another fit comes after some months; and the disease becomes established in paroxysms, which almost every time recur at a less interval and more severely; till at last in some cases the disorder becomes *chronic* and *habitual*. The joints affected return to their usual pliability after the first few attacks, but gradually become stiff and crippled, and deposits of *lithate of soda* are formed in them.

Besides these evils, gouty persons are liable to various anomalous and dangerous affections of internal organs. Sometimes they are seized with pain of a cramp-like character in the stomach, with coldness and deadly sickness;—sometimes with extreme pain of the heart, palpitation, and dyspnœa;—sometimes with furious delirium and headache, or coma; and as these symptoms are relieved by the appearance of gout in the foot, it is evident that they arise from the gouty poison; and such attacks are often called *misplaced gout*. If

symptoms come, upon the gout leaving the extremities, the
s said to be one of *retrocedent gout.*
ty people are also liable to inflammations of the eye, lungs,
her parts, which are very stubborn when treated with common
ies, but yield generally to colchicum.
the *stomach*, gout may assume two opposite forms,—one, that
ent acute gastritis, the other that of spasm. In the *bowels*, it
the form of colic or diarrhœa. In the *lungs*, it produces bron-
congestion or dyspnœa. In the *heart*, it produces excessive
ssion, dyspnœa, and syncope. In the *kidneys*, violent ne-
s.
*ronic Gout* is generally the result of the acute. The attacks
equent, but without fever; there is a purplish colour and œde-
s appearance of the parts, from synovial effusions. It is dis-
to wander from joint to joint.
*rvous Gout*, called also *atonic* or *irregular* gout. This variety
in persons of hereditary gouty tendencies, but whose consti-
s have been modified by a careful mode of living, hence its
ency in women and nervous men.
ny cases of supposed neuralgia are really cases of nervous gout.
ain may be dull or lancinating, fixed or fugitive, confined to a
part, as the head, or distributed over many parts. Often it
ys itself in *disordered function*, as dyspepsia, dyspnœa, cough,
ations of the heart, irregular pulse, dizziness, syncope, &c. It
rove fatal by a sudden retrocession to some vital organ, as
eart; or, by its frequency, inducing some organic disease.
*uses.*—There is always a predisposition or diathesis, either in-
d, or artificially created by luxurious living and indolent
. In such persons, the slightest cause may bring on a
ysm.
*ture.*—Not well known. By some it is attributed to an excess
acid in the blood: but this will not explain *all* the phenomena.
d, this very excess of acid is itself the *result* of the gouty dia-
, rather than the cause.
*gnosis.*—It presents many resemblances to rheumatism, but
in the following points:—1. Rheumatism affects chiefly the
or middle-aged; gout, the elderly. 2. Rheumatism prefers
rger joints; gout, the smaller, and especially the feet and
. 3. Gout is attended with more obvious disorder of the
ive organs; the pain is of a more burning character, and the
ng greater and more vividly red.
*atment during the paroxysm.*—It is important to remember,
e disease is not merely local, and hence that it is dangerous
l it by violent means. Commence with a brisk cathartic, as
l or senna draught, followed by laxatives, if necessary. The
emedy is *colchicum*, which is to be exhibited as soon as the

bowels are open, in doses of 20 or 30 drops of the wine, every four hours, either alone, or in combination with magnesia and Epsom salts. Blue mass and bicarbonate of soda may be given at the same time, and a full dose of Dover's powder, at night, to relieve the pain.

As regards the *local* treatment, very little should be done. The part may be bathed with warm water, or wrapped up in flannel, or the mildest camphor liniment applied. Cold water is very dangerous. *Bleeding* should not be practised, except to relieve violent internal inflammation; and even in that case it is better to try to call it out to an external part by revulsives.

The *diet* should be low at first; though, in the intemperate, some latitude is to be allowed.

*Treatment in the interval.*—The chief indication here is to correct the habits of the patient, so as to remove the diathesis. The diet should be moderate, but not too abstemious; vigorous exercise, especially on horseback, should be enjoined. All the functions should be sedulously attended to; the bowels kept regular; acidity of stomach corrected, and the secretion of the liver preserved. A pill containing one grain of blue mass, one of acetous extract of colchicum, and three of the compound extract of colocynth, may be taken with advantage.

In chronic gout, attention should be directed to the digestive and secretory organs; acidity is to be corrected; iron is often of advantage, and also the iodide of potassium; but, especially, a long journey or voyage.

In nervous gout, the general rule is to give the disease an external direction, by revulsives. If intermittent, quinine, in large doses, is the proper remedy. Anodynes are often required, of which opium and aconite are the best. The tincture of the root of aconite, and chloroform, are excellent *external* applications.

For sudden attacks of gout in the stomach, heart, &c., the indications are to put the feet in hot mustard and water, to apply mustard poultices to the epigastrium, and to give some warm stimulant internally. These may be followed, as soon as the symptoms permit, by a dose of calomel and opium, succeeded by a laxative to remove the offending matter from the stomach and bowels.

# CLASS II.

# LOCAL DISEASES.

## SECTION I.

## DISEASES OF THE ORGANS OF DIGESTION.

### STOMATITIS, OR INFLAMMATION OF THE MOUTH.

s may be of various kinds.

#### I. COMMON DIFFUSED INFLAMMATION

urs either in patches, or covering the whole surface. It is ed occasionally with submucous infiltration and enlargement uvula. When more especially confined to the fauces, it is l *angina*. The *treatment* consists in a saline purge, and a of sage tea and alum. When chronic, the astringent vege- or mineral washes may be used.

#### II. FOLLICULAR INFLAMMATION

sists in little enlarged prominences, scattered over the lining rane, of the size of a small shot. They are enlarged mucous es, and are sometimes disposed to ulcerate. The disease is y chronic. When between the palatine arches, it constitutes clergymen's sore throat." It sometimes extends far down the nx, running into ridges, and secreting a tough mucus. It is kept up by low health; hence in treating it, remedies must be tutional as well as local. The best local application is a strong on of nitrate of silver, applied daily.

#### II. APHTHOUS, OR VESICULAR INFLAMMATION.

his variety there are small whitish ulcers, either isolated or in s. The ulcers are preceded by pearl-coloured vesicles. It s both children and adults, and extends down, occasionally, into omach. The *treatment* is chiefly local, and consists of the tion of a strong solution of the sulphate of zinc (15 to 20 the ounce), or of sulphate of copper, or nitrate of silver.

#### IV. THRUSH, OR MUGUET.

inflammation, accompanied by an exudation of a whitish curd- tter, in patches, generally confined to young children, though nes occurring in adults, in the advanced stage of low diseases, as phthisis or dysentery. Infants badly nourished, especially artificially, are most exposed to it. At first, there is redness, then little whitish spots about the corners of the mouth and inside of the lips, which run together so as to form patches of a whitish or grayish matter, which can be scraped off. The microscope shows it to consist of a cryptogamous plant. It is not contagious. It is, probably, a consequence of some constitutional derangement.

*Treatment.*—In good constitutions give a laxative, as magnesia or castor oil, and apply a mixture of equal parts of borax and loaf sugar. If obstinate, use the sulphate of zinc. Attend also to the diet, and fresh air. If there is diarrhœa, use test. ppt. and opium; if constipation, use magnesia; tonics and iron if debility is present.

### V. PSEUDO-MEMBRANOUS INFLAMMATION.

This consists in a fibrinous exudation, usually of a whitish colour and firm consistence, though in depraved constitutions it may be dark. The surrounding inflammation is slightly elevated, so as to give the patches the appearance of ulcers. It is sometimes termed *diphtheritis*. There are also pain and swelling, together with fetor of the breath, causing it to be mistaken for gangrene. The constitutional symptoms are fever, diarrhœa, sometimes vomiting, and a sero-purulent discharge from the nose, as in scarlatina. It may be either of the sthenic or asthenic character.

*Cause.*—Some predisposition of system, or depravity of the blood. It is frequently epidemic.

*Treatment.*—In good constitutions, the antiphlogistic plan, without bleeding; *mercury* may be used if it is spreading into the larynx. In the low cases, a good diet and stimulants are requisite. The *local treatment* is very important; it consists of a solution of nitrate of silver, 20 to 60 grs. to the ounce, applied only to the affected parts.

### VI. ULCERATIVE INFLAMMATION OF MOUTH.—CANCRUM ORIS.—CANKER.

Any inflammation of the mouth may result in ulceration. But this affection consists in an ulcer from the very commencement. It occurs on the gums, inside of cheeks, fauces, and lips. Sometimes the ulcer is deep and destructive, and is accompanied by an offensive breath. It generally occurs in children of a debilitated habit, though sometimes in those who are otherwise apparently healthy.

The *treatment* consists in a mercurial cathartic, followed by laxatives; and, in protracted cases, iodide of potassium, but especially the *local* application of a strong solution of sulphate of zinc (20 grs. to an ounce of water), or sulphate of copper, or nitrate of silver.

## GANGRENOUS INFLAMMATION, OR GANGRÆNA ORIS.

peculiar form of disease—gangrenous from the first. It occurs frequently in the inside of the cheek and gums. It is very ctive to the tissues involved, often causing necrosis of the great exhaustion, and frequently death. It usually attacks lthy children in miasmatic countries, also in infirmaries where ers of children are crowded together, and not subjected to r hygienic treatment.

*atment.*—Obviate the depressing cause by good diet, country nics, quinine, &c. The *local* means are a strong solution of ate of copper (ʒss to f℥j, Dr. Coates), or the other astringent s above recommended; also the tinc. ferri chlorid.

## GLOSSITIS, OR INFLAMMATION OF THE TONGUE.

s disease may be produced in various ways, as by local injury, effects of mercury, and occasionally as an idiopathic affection. attended with swelling, which, in some cases, becomes exces- so as to fill up the whole mouth, and even prevent deglutition espiration; in such cases it is, of course, dangerous. The *ent* is copious bleeding and leeching under the jaw, emollient ces, saline cathartics, and, if the danger is imminent, free cation longitudinally into the substance of the tongue.

## TONSILLITIS, OR QUINSY.

inflammation of the tonsils, one or both. If severe, it is ac- nied by fever. The pain is increased on swallowing, and extends to the ear. If both glands are affected, the swelling be so great as to impede respiration. It naturally tends to ration in five or six days, after which great relief is expe- d.

*cause* is generally cold, though in many persons a predispo- to it exists.

*atment.*—An antimonial emetic may set it aside if given at ery forming stage. Bleeding, purging, and warm emollient ces, kept constantly applied, and ice allowed to melt in the , give great relief. After the fourth day, it will be better to suppuration, and then open the abscess.

*chronic* form often causes a permanent enlargement of the , which may require amputation, or the application of the nitrate of silver, iodide of zinc, or tincture of iodine. It is requent in scrofulous children.

### INFLAMMATION OF THE PHARYNX.

This affection, which constitutes what is commonly called sore throat, may be easily detected by an inspection of the pharynx, which presents a uniform dark-red colour, and is frequently spotted with whitish patches. The general symptoms resemble much those of tonsillitis, but there is seldom any marked degree of fever, and no difficulty of respiration. The leading signs are, redness at the back of the fauces, pain, and difficult deglutition, and a copious secretion of mucus from the part.

*Treatment.*—General bloodletting will seldom be required. If the pain be very severe, leeches may be applied externally to the neck, and the bowels should be freely opened by active purgatives. At the commencement, the inhalation of steam affords most relief; and as the inflammation subsides, recourse may be had to astringent or stimulating gargles, nitrate of silver, and the internal use of ice.

### GASTRITIS—INFLAMMATION OF THE STOMACH.

Inflammation of the mucous membrane of the stomach may be either chronic or acute. The latter, however, is very rare, as an idiopathic disease.

*Causes.*—The chief causes of acute gastritis are, external violence; acrid poisons (the most frequent cause); and cold drinks taken whilst the body is heated.

*Symptoms.*—Heat and acute pain over the stomach, increased on pressure, or by coughing, or deep inspiration; instant vomiting of the matters ingested; constipation and prostration of strength. The pulse is usually quick, small, and irregular; the tongue clean, and red at the point or edges. The skin is hot and dry; there is thirst, and a desire for cold drinks. The disease is attended with great depression of the heart's action through the influence of the solar plexus of the great sympathetic. As it advances, the face becomes collapsed, the extremities cold, and the patient lies in a state of complete prostration; cerebral symptoms now supervene, the abdomen becomes tympanitic, and death soon closes the scene.

The anatomical characters of acute gastritis are those of inflammation in general, but they may vary according to the exciting cause. Thus certain mineral poisons may give rise to peculiar states of the mucous membrane. In some cases, the inflammatory injection and thickening are confined to particular spots; sometimes they follow the course of the principal blood-vessels, and on other occasions the whole mucous membrane presents a uniform vivid or dark-red colour; but ulceration is rare.

*Treatment.*—The first indication of treatment in this, as in all affections, is the removal of the exciting cause. Should the ace of any poison be suspected, the proper antidotes are to be e administered, or vomiting excited; circumstances alone can mine an election. Blood must be freely drawn from the arm ere cases, and the venesection repeated according to circumes; leeches, also, should be freely applied over the epigastric n. The pulse will often be found to rise in force and fulness bleeding. Warm fomentations, containing an anodyne, will be useful in allaying the pain, but some prefer the immediate ation of a large blister over the region of the stomach, and of isms to the feet. The thirst may be allayed by the frequent nistration of cold water or of ice, in small quantities, but it will visable to abstain from giving medicines by the mouth, except el, which is often well borne by the stomach, as long as acute mmation exists. If any be given, they should be of the least ting nature. It is more prudent to administer laxatives by ectum, to trust to general bleeding and strict regimen, with sives or counter-irritants; small doses of calomel and opium in some instances be advisable, and if the disorder persists, ry should be given, so as to produce gentle ptyalism. If enous symptoms come on, give oil of turpentine and morphia.

## CHRONIC GASTRITIS.

s is an occasional cause of the severer forms of dyspepsia, and en attended with one or more ulcers in the stomach.

e *symptoms* of chronic gastritis are extremely various, both in er and intensity. The following, however, are usually present ll-marked cases:—Pain and uneasiness about the region of the ch, particularly increased after meals; sense of constriction in sophagus, near the lower part of the neck; imperfect digestion, panied by eructation, nausea, and occasional vomiting of food, mucus streaked with blood; skin dry, but not warm; pulse natural, but sometimes accelerated; tongue covered with a h fur, or red at the tip and edges, or dotted with red spots development and injection of the papillæ. Emaciation is very us. The patient often exhibits symptoms of hypochondriasis, he spirits become low as the disease advances. It may last for varying in its intensity.

eration into the colon, liver, spleen, or peritoneum may occur.

*post mortem appearances* are dark-coloured patches, with great ement of the follicles; thickening, softening, or hardening, mucous coat, with ulceration.

*uses.*—It may result from the acute; but is usually an original e.

*atment.*—The principal indications are fulfilled by the application of leeches to the region of the stomach, followed up by external irritation and a careful regulation of the bowels. Strict attention should also be paid to the diet. The patient should eat nothing but very light food, at regular intervals, and the general health should be improved by gentle exercise in the open air. In some cases, the stomach is so irritable that no food of any kind can be borne. Equal parts of lime-water and milk, given by spoonfuls at a time, may be tried, and very small doses of prussic acid; but if all these measures fail, it will be advisable to abstain from administering food by the mouth, and to support the patient by nutritious enemata. The most efficient *medicine* is nitrate of silver, which will generally cure uncomplicated cases; the dose is a quarter to one-third of a grain, with one-sixth of a grain of opium, four times a day; it should be increased up to one grain. After the subsidence of all symptoms, the tone of the digestive organs may be improved by mild tonics; but the best strengtheners will be found to consist in moderate exercise and a strict attention to diet.

## DYSPEPSIA.

This term is often used to signify any derangement of the digestive organs; it more strictly imports "a depression of the functions of the stomach" (Wood); though there may accompany it symptoms of irritation.

*Symptoms.*—A vague sense of uneasiness in the epigastrium, extending to the shoulder, and greatest when the stomach is empty, but replaced by positive pain when it is full. This pain may be of a neuralgic character (*gastralgia*), or spasmodic. The appetite is much deranged; eructations of sour wind and regurgitation of undigested food often occur. Various disordered sensations, as headache, giddiness, cough, palpitations of the heart, low spirits, &c., are present. The tongue is covered with a whitish fur in the mornings; bad taste in the mouth; constipation; deranged hepatic secretion; dry skin; pulse often natural. Emaciation gradually comes on, attended with a pale, sallow skin. It may terminate in chronic gastritis.

*Causes.*—Sedentary life and errors in diet, which depress the energies of the stomach by first over-stimulating them; abuse of alcohol, opium and condiments, by wearing out the healthy susceptibilities of the stomach; whatever calls off the energies of the stomach, as excessive exercise, or study; the use of narcotics, as tobacco; the depressing passions; improper use of cold drinks.

The depressing influence, however produced, interferes with the secretion of the gastric juice and the peristaltic action of the stomach.

*Treatment.*—Remove the cause by regulating the diet and exer-

The *diet* should consist of stale bread, mealy, well-boiled
oes, milk, ice cream, butter if very fresh, wild meats in prefe-
to domestic; of the latter, poultry, beef and mutton, roasted
led; oysters raw or roasted. The *cooking* is of the greatest
quence. The *drink* should be generally water,—coffee and
e injurious; wine of the best quality should be cautiously
d, as also porter, occasionally. The food should be taken
ntly, and in small portions.

*ercise* is of great importance: it should be adapted to the state
case. Horseback exercise is, on the whole, the best. Salt
g is often of benefit.

*medical* treatment should be such as to meet the various in-
ns. A combination of tonics, laxatives and antacids usually
rs well. Small doses of blue mass are often beneficial. Rhu-
aloes, and magnesia are the proper cathartics; the mineral
especially the nitro-muriatic, are useful in deficient appetite
bad breath. In flatulence, use a combination of astringents
urgatives. The habitual use of alkalies depresses the stomach,
hould therefore be avoided; the best are bicarbonate of soda,
sia, and aromatic spirit of ammonia. The shower-bath is
if reaction is fully established.

eral symptoms which frequently accompany dyspepsia, and
rather from an *irritable* stomach may be briefly alluded to.

*rdialgia* or *heartburn*, usually referred to the presence of acid
stomach, is relieved by antacids.

*stralgia* or *Gastrodynia* is a true neuralgic condition of the
ch. It is best treated by opium, hydrocyanic acid, sinapisms,
ia endermically applied, bismuth, or nitrate of silver, cups to
ine, hot stimulating drinks, as ginger tea, &c.

*rosis*, or *Water brash*.—This occurs in painful paroxysms,
accompanied by cardialgia. The fluid comes up in repeated
tions of a thin glairy character, and usually when the stomach
ty. The remedies are bismuth, nitrate of silver, oil of amber,
ux vomica.

*sm*, or *Cramp*, occurs in paroxysms; the pain is often excruci-
with a *depressed* pulse, cool skin, &c. It requires opium,
tics, sinapisms, &c.

*usea and vomiting* may be caused by offending matters in the
ch, as acid or undigested food. Again, they may be purely
thetic. They should be treated by mild emetics if depending
d accumulations; or by lime-water and milk, carbonic acid
and aromatic ammonia.

*Headache* is a frequent accompaniment of dyspepsia. It
epend on indigestible food, or acid in the stomach, and is best
by magnesia, aromatic ammonia, tonics, or a calomel purge,
ndent on hepatic congestion. When habitual, it can almost

always be relieved by giving a grain of sulphate of quinine, with one-twelfth of a grain of sulphate of morphia, in anticipation of the paroxysm.

## ENTERITIS.

This term signifies inflammation of the mucous coat of the small intestines; although the muscular and serous coats may also be involved. It occurs in the acute and chronic forms.

*Symptoms of the acute.*—Pain of a griping character about the umbilicus, caused by a spasmodic contraction of the bowels, which precedes an operation and is relieved by it; tenderness on pressure; more or less diarrhœa, fever, and tympanitic abdomen, especially in children. If the muscular or peritoneal coat be attacked, constipation may take the place of diarrhœa. Ulceration is rare except from the presence of foreign bodies, as a grape-seed in the appendix. It is most apt to occur about the ileo-cœcal valve.

*Causes.*—Crude ingesta in the bowels, and cold.

*Treatment.*—Bleeding not usually necessary. Calomel the best purge, because the least irritating, to be followed by castor oil; but often it is not requisite, from the existence of diarrhœa, in which case give castor oil and laudanum, or magnesia, if there be acid. Regulate the diet; apply leeches to the abdomen over the painful spot. Dover's powder at night; the warm bath, especially for children; emollient poultices to the abdomen. If it does not yield in four or five days, use blue mass in combination with opium and ipecac., and apply a blister.

The *chronic* form is of common occurrence, most cases of chronic diarrhœa being of this nature. There is generally some febrile action towards evening. The discharges vary, being either feculent or bloody, indicating ulceration; or mucous, indicating colitis. In protracted cases, great emaciation occurs, with a dry skin, a red or gashed tongue, and depression of spirits. A frequent cause of its obstinate character is the presence of tubercles.

The *autopsy* reveals the usual evidences of chronic inflammation, as thickening, ulceration, &c., together with the existence of tubercles.

*Treatment.*—Opium is indicated in combination with ipecacuanha; castor oil and laudanum if there are acid accumulations in the bowels; chalk and opium if the discharges are excessive. At the same time use sulphate of copper in doses of $\frac{1}{8}$th to $\frac{1}{4}$th gr., with a little opium, three times a day. Nitrate of silver or sulphate of zinc are also useful, with sugar of lead and opium to check the discharges. In the advanced stage, when there is a low condition with a smooth tongue, the terebinthinates will be found useful; and if other means fail, *mercury*, pushed to a moderate salivation.

The external means are leeches, blisters, fomentations, and the

t bath. The *diet* should be carefully regulated as in chronic
is.

## COLITIS OR DYSENTERY.

entery is an inflammation of the mucous coat of the colon; it
ntly also extends to the rectum.

*nptoms.*—Griping pains, or *tormina*, of the abdomen, very
before going to stool, and somewhat relieved by the dis-
s, which are very frequent, amounting sometimes to forty or
n a day. The dejections at first may be feculent, but after-
they are small, and consist of mucus or blood, and sometimes
ordered bile. There is also constant straining at stool (*tenes-*
In advanced stages the stools acquire a peculiar odour, the
nen becomes tender and tympanitic, and often the precise
f inflammation is indicated by the pain experienced on touch-
t. Towards the last, the discharges become profuse and
y, of a dark colour, resembling the washings of flesh.

netimes prostration sets in from the first; though generally in
ginning the condition is sthenic. It is sometimes associated
the typhous condition, which imparts to it a low and dan-
s character, and has caused it to be regarded as contagious.
ner complication is with miasmatic fever, especially in the
d States.

*gnosis.*—Mild cases recover in ten to twelve days; but fre-
ly it is a dangerous and fatal disease, especially in hot
tes and in crowded situations.

*rbid appearances.*—Traces and effects of inflammatory action
ious degrees are to be found in the rectum and colon. The
is coat is more or less injected in several points, and certain
ns of the cæcum and colon are either ulcerated or entirely
anized, the membranes hanging by shreds into the interior
bowel. The ulcers are sometimes small and numerous; at
times they are elevated, hardened, and covered with sloughy
gous granulations. Some parts of the great intestine may be
tate of sphacelus; and more or less coagulable lymph, mixed
shreds of disorganized cellular tissue, adheres to different
s of its surface.

*uses.*—The chief causes of acute dysentery are, exposure to
lamp air; acrid indigestible food; spirituous liquors, and expo-
o unwholesome exhalations. It prevails most in autumn, and
l by some writers to be contagious.

*atment.*—In mild cases, a full dose of castor oil with twenty
of laudanum. If more severe, with much fever, bleed, and
full dose of calomel, followed in a few hours by castor oil,
which use the *Oleaginous mixture.* If there is much pain
hot, dry skin, small doses of the saline cathartics, especially

Rochelle salts, with a little paregoric, are useful. *Opium* is almost indispensable; a full dose of Dover's powder may be given at night, and afterwards used in smaller quantities. *Mercury* will be generally required; three grains of calomel may be given with the opiate at night, after which small doses should be taken every few hours.

*Acetate of lead* is not useful in the early stage; but as an injection in hemorrhagic cases it is very beneficial. For the same indications, sulphate of zinc, sulphate of copper, and nitrate of silver, are often prescribed, in the advanced stage. By some, *Hope's acid mixture* is recommended.

The *local* means are,—leeches or cups to the painful spot, warm fomentations to the abdomen, blisters in the advanced stage, frequent injections of starch, or animal oils and laudanum, and large mucilaginous enemata to relieve the tenesmus.

Oil of turpentine and copaiva are often taken internally in the latter stages, with great benefit; they act as alteratives upon the diseased membrane. If connected with miasmata, quinia is the important remedy.

The diet should be very low at first, but the debility should be counteracted by animal broths, jellies, wine whey, &c.

### CHRONIC DYSENTERY.

This is usually the result of the acute form. It is often complicated with chronic enteritis. The stools are much less frequent than in the acute variety, and they are more or less feculent, mingled with mucus, and more rarely with blood. There is occasional pain on pressure, with some tormina and tenesmus. The pulse, skin, and tongue are much the same as in chronic enteritis.

After death, thickening and ulceration of the mucous coat are generally observed.

The *treatment* consists chiefly in the regulation of the diet, occasional local bleeding, the hot salt bath, together with the occasional use of laxatives and of opium and ipecacuanha. The *alteratives* are particularly useful—as sulphate of copper, copaiva, and oil of turpentine. If there are evidences of ulceration of the rectum, an injection of sulphate of zinc and opium, or of nitrate of silver, will prove advantageous.

Tonics may also be given with advantage in the chronic stage, particularly when the disease assumes an asthenic form. Those generally administered are cinchona, and the infusion of serpentaria, colomba, or simaruba barks. Great attention should at the same time be paid to the condition of the liver; the bowels must be kept regular, and all errors of diet, or exposure to damp, cold, &c., carefully avoided.

## COLIC.

s disease is characterized by severe griping pains in the
, with costiveness, and frequently with vomiting. Colic may
duced by a variety of causes, the most common amongst which
rritating ingesta, flatulency, or a morbid sensibility of the
s membrane.

*nptoms.*—Severe twisting or griping pain in the abdomen,
larly in the umbilical region or along the course of the colon;
in is not increased by pressure, nor is there any fever,—cir-
ances which distinguish the disease from peritonitis and ente-
it comes on in paroxysms, and in the intervals there is perfect,
tial ease; it usually comes on quite suddenly; the muscles of
domen are often retracted; the patient also complains of bor-
mi, or rumbling noises from flatus in the canal. If very vio-
there is great prostration of system, with a cold skin and
pulse. Occasionally there is vomiting, and that of a stercora-
character, when the contraction is low down in the intestines.
*ious colic* is that variety occurring in the summer and autumn,
ced by some hepatic disorder; there is often a jaundiced
ance of the skin and eyes, together with tenderness in the
of the liver, and vomiting of a bilious matter. It often oc-
long with miasmatic diseases, and in the same regions.
er varieties are the *gouty* and *neuralgic.*

*atment.*—The first care of the practitioner should be to deter-
if possible, the exciting cause of the colic, and whether it be
oned by an organic disease, such as hernia, intus-susceptio,
rs, &c. This done, and the complaint having been ascer-
to be simple colic, he may at once administer anodynes com-
with cordials, and proceed to evacuate the intestinal secretions
use of enemata and mild purgatives. For this latter pur-
he blue-pill will be sufficient, or castor oil with laudanum,
er with hot fomentations.

stomachic colic, with nausea, use a mild emetic, or copious
its of warm water.

athartics will not act, use enemata freely, gradually increasing
trength.

bilious colic, calomel and opium are the proper remedies,
ossibly, bleeding or cupping, and in malarious regions, qui-

he rheumatic and gouty forms, a mild cathartic, followed by
s powder and colchicum.

neuralgic form requires anodynes freely, together with col-
, aconite, belladonna, &c.

### COLICA PICTONUM—PAINTER'S COLIC.

*e.*—Exposure to the poison of lead. M. Andral considers lead colic as a neurosis, in which the spinal marrow and abdominal plexuses of the great sympathetic appear to be the peculiar seat of lesion. The constipation seems to depend either on the abolition of the contractile motion of the intestines, or on the suspension of the secretion of the intestinal mucus.

*Symptoms.*—Violent pain at the umbilical region; sickness and obstinate constipation; pains in the wrists, ankles, and neck; headache; bitter eructations; and occasionally paralysis of some of the voluntary muscles.

*Treatment.*—The best mode of treatment consists in the free administration of purgatives with opiates, such as calomel and opium, followed by castor oil and laudanum; croton oil will sometimes be required to overcome the constipation. A warm bath should be given, with injections of a large quantity of warm water into the bowels whilst the patient is in the bath. If these measures fail, mercury should be used, to ptyalism.

Dilute sulphuric acid, made into a kind of lemonade, and extreme cleanliness, are the best preservatives from the poison of lead.

Paralysis of the limbs sometimes accompanies lead colic, and remains after the removal of that disease. Here great attention must be paid to the bowels, and on the least indication of costiveness the purgative salts should be administered. The diet should be generous; friction along the limbs with stimulating liniments should be practised, and the extract of nux vomica or strychnine administered internally. Great good is produced by supporting the paralytic limb in splints.

## ILEUS.

This complaint consists of very severe colic with obstruction of the bowels, and generally ends in inflammation.

*Symptoms.*—Violent griping and twisting pains about the umbilicus, which is retracted; obstinate constipation; nausea, and vomiting of stercoraceous matter; tension and tenderness of the abdomen. The pulse is at first natural and the skin cool, but febrile symptoms soon set in, and are followed by hiccup, prostration, cold sweats, sinking, and death.

*Morbid appearances.*—Mechanical obstruction in some part of the intestinal canal produced by knots of the bowels; intussusception; adhesions; bands of false membrane; strangulation of the gut; organic constriction of its calibre; foreign bodies, such as fruit-stones, &c. The parts of the intestine above the obstructed point are generally dilated and inflamed, and in many cases the inflammation has extended to the peritoneum, producing its usual results.

Invagination of the intestine most frequently occurs in children, and, in addition to the symptoms already enumerated, may some-

be recognised by the presence of a painful tumour over the
nated portion of gut.

*atment.*—The medical treatment of ileus will seldom be of
rail, as may be readily inferred from a consideration of the
ogical conditions with which it is connected. The forcible in-
of air per anum has been recommended. Copious enemata
ntly repeated, thrown high up into the bowels, by means of a
e tube, and mild purgatives given in moderate doses, regularly
ed, may be tried first. If they do not succeed, stronger pur-
s may be tried, such as croton oil. But if the purgatives add
sickness and pain, they should be suspended. Crude mercury
ge quantities has been given by the mouth, and in some in-
s with relief. If inflammatory symptoms arise, they should
nbatted by bleeding or leeches, and the warm bath. The ope-
of gastrotomy has been frequently performed for the cure of
and there are two or three cases of success on record. The
objection, however, to its performance is, the obscurity and
ainty of the symptoms. When the case seems hopeless, the
t's sufferings should be soothed with opiates, and his strength
ip by nourishing enemata.

## PERITONITIS.

*uses.*—Inflammation may exist at any point of the peritoneal
ut the term peritonitis more properly belongs to inflammation
t portion which does not invest any of the viscera. The *cause*
itonitis are the same as those of inflammation in general; be-
which are, external violence, metastasis, disease of the mesen-
glands, obstruction of the bowels, the irritation produced by
e of neighbouring viscera, and the effusion either of the con-
of the alimentary canal, or of the urinary bladder, &c.

*nptoms.*—Acute pain, commencing at a particular part of the
ien, and gradually extending over the rest of the surface; ri-
followed by heat of skin; frequency and smallness of the
; in many cases, nausea and vomiting; constipation; anxious
enance; tongue dry, but not foul; respiration accelerated and
; urine scanty. The patient lies on his back, with the thighs
, and cannot bear the slightest pressure on the abdomen,
becomes tumid or tympanitic. In addition to these general
oms, others will present themselves, according to the vicinity
part inflamed to any of the principal abdominal viscera. Pe-
is from intestinal perforation is characterized by the sudden-
nd the rapid progress of the symptoms, and the great accom-
g prostration.

*bid appearances.*—Injection, by patches, of the sub-serous
effusion of lymph, or a sero-purulent fluid, into the cavity of

the abdomen; adhesions, by means of soft, whitish false membranes, between the folds of the intestines.

*Treatment.*—Bloodletting, to be repeated according to the patient's strength, &c.; leeches very freely applied over the painful parts, and warm fomentations, are the chief means on which reliance is to be placed at the onset of the disease, together with a full dose of calomel, followed by castor oil; small doses of calomel should now be given, until the mouth becomes sore; and the bowels must be kept open subsequently with gentle laxatives or enemata. If the tympanitis be troublesome, enemata containing turpentine or assafœtida may be administered for the sake of obtaining temporary relief. In peritonitis from perforation of the intestinal canal, the only hope of saving the patient lies in the instant administration of opium, in doses sufficient to arrest the peristaltic motion of the bowels. This gives us some time for the employment of other means, with a faint chance of success.

### CHRONIC PERITONITIS.

Chronic peritonitis is sometimes a sequel of the acute disease, sometimes, on the contrary, it begins in a very obscure and insidious manner, and is attended in scrofulous subjects by a deposit of granules or tubercles external to the membrane.

*Symptoms.*—Slight occasional abdominal pains, often scarcely noticeable, increased by pressure; fulness and tension of the belly, particularly a deep-seated tightness, as if the integument and muscles glided over the tight and thickened peritoneum; feverishness and emaciation.

This disease is often attended by enlargement of the mesenteric glands, with which it is usually identical in symptoms,—also with ascites.

*Morbid appearances.*—The peritoneum thickened; the bowels glued together; the abdomen containing more or less turbid serum; perhaps ulceration of some part of the bowels; the omentum thick, red, and fleshy.

*Treatment.*—Occasional leechings, blisterings, frictions, and flannel bandages to the abdomen; or warm fomentations and poultices, if the pain is very severe; nourishing diet; small doses of mercurials, and mild laxatives and antacids. If anæmia be present, use iron and iodine.

### WORMS.

There are three species of worms which most commonly inhabit the intestinal canal—viz., the *ascaris lumbricoides*, *ascaris vermicularis*, and *tænia*.

The *lumbricus* is a round worm, varying in length from four to

inches; the tail ends in a blunt point; the head is sharp, and
tween three oblong tubercles.

ascaris *vermicularis* is very thin, and does not exceed an
n length, but it is usually shorter; the tail terminates in a fine
It inhabits the rectum.

*tænia* is a very long, flat worm, articulated, and furnished
four suckers at the head. Two species of *tænia* are met with
n. They infest the small intestine.

rms very frequently exist in the intestinal canal without pro
g any irritation or inconvenience whatever; on other occasions
ver, they are attended with the following symptoms:—disgus
d, or irregular appetite; nausea, vomiting, griping pains in the
nen; tenesmus; disturbed sleep; irregular accessions of fever;
athetic irritation of the nose and anus; diarrhœa, with slim
; foul breath; headache; dilatation of the pupils; strabismus;
ation; and, in young children, cerebral disturbance, or con-
ns. Ascarides often produce a sensation of itching about the
while the lumbricus occasions pain of a gnawing character in
mbilical regions. The stools should be constantly inspected,
e presence of the worm in them alone can render us certain o
rrectness of the diagnosis.

*atment.*—The objects of treatment are, to destroy and expel
rasitical animals, and to prevent their return. For this pur-
various remedies, called anthelmintics, are administered.
non purgatives will sometimes suffice to expel the worms.
d these fail, we may employ the mucuna or *cowhage*, or tur-
ne. Calomel is often a very efficient anthelmintic, from the
bile that it pours out. It is particularly serviceable in cases o
en. Other anthelmintics much employed are wormseed or its
nd spigelia.

*tape-worm*, oil of turpentine is one of the best remedies, in
of f℥ss to f℥ij, given either along with, or followed by casto
Lately *kousso*, the powdered leaves of an Abyssinian plant, has
highly extolled in tænia.

Raspail regards camphor as a specific against ascarides; and
ance and Italy the root of the pomegranate is employed with
s in cases of tænia. The condition of the bowels should be
lly regulated, and all errors of diet avoided, for worms are
y found upon children who are ill fed upon unwholesome and
stible vegetable food. After the complete evacuation of the
tical animals, a course of vegetable or mineral tonics has been
mended; but wholesome food, exercise, and a proper regimen,
e found the best means of preventing their recurrence.

## DIARRHŒA.

rrhœa consists in the copious and frequent discharge of alvine evacuations, which are generally fluid, without tenesmus or fever.

The *symptoms* are, frequent discharge of mucous or slimy stools, containing feculent or ill-digested matters, with griping pains, nausea, and foul tongue. The state of the skin is generally natural.

*Causes and Treatment.*—The causes of diarrhœa are very various, and so must be the treatment adapted for various cases.

1st. *Inflammatory diarrhœa.* This arises from irritation, inflammation, or ulceration of the intestines, and is a frequent attendant of fever, phthisis, &c. It is characterized by pain, tenderness, thirst, and slimy evacuations; and is to be relieved by small doses of hyd. c. cretâ, and pulv. ipec. c.; injections of starch and laudanum; rubefacients or fomentations to the abdomen; chalk mixture, &c.

2d. *Diarrhœa* from *unwholesome food*, or *irritating substances*, or foul accumulations in the intestines. This is a very common form, being often produced by unripe fruit, and it is in fact what is caused by a common dose of physic. This form of diarrhœa tends to work its own cure, which is best accelerated by a dose of rhubarb and magnesia or castor oil, followed by chalk mixture.

3d. *Diarrhœa* from *debility* and *relaxation.*—This form is apt to follow any of the others, and is to be recognised by the kind of constitution to which it happens, and by the freedom from active symptoms. The various vegetable and mineral astringents with opium are the remedies.

4th. *Diarrhœa* in *young children* often arises from the irritation of weaning, or from an unnatural quality of the milk, or from attempts to bring up children by hand. A very small dose of hydr. c. cretâ with rhubarb, followed by chalk mixture with five or ten minims of paregoric, are the remedies. Baked flour or biscuit powder may be tried as food.

In all cases of diarrhœa it is important to attend to the skin, and to keep it warm.

## CHOLERA MORBUS.

*Causes.*—Constant exposure to a high temperature producing congestion of the liver; indigestible food; putrid miasmata; certain seasons.

*Symptoms.*—Violent griping pain, followed by frequent vomiting, and purging of greenish bilious matter; spasms of the abdominal muscles, sometimes extending to the legs and arms; tongue dry; urine high-coloured, scanty, or suppressed; thirst urgent; pulse frequent, but soon becoming small and weak. As the disease continues, the spasms become more severe, the countenance anxious and collapsed; the strength is much reduced, and fainting occurs.

As cholera morbus depends on simple irritation of the mucous

of the alimentary canal, the morbid appearances after deat
ot very remarkable, consisting in some injection or congestio
vessels.

*eatment.*—In the very early stage, use warm diluent drink
est of which is warm chicken tea; and apply a sinapism ove
pigastrium. To allay the spasm and irritable state of th
tive canal, calomel and opium should be administered in smal
, as one-sixth of a grain of the former, and one-twelfth of a grai
e latter, every half hour; larger doses in violent cases, an
repeated injections of gruel or starch in large quantities, t
away the irritating matters;—and opiates. Warm foment
may be applied over the abdomen, or the turpentine, or ammo
l liniments. When the surface of the body becomes extensivel
and symptoms of exhaustion appear, it will be necessary t
nister stimulants, as camphor, ammonia, small quantities o
ly, &c., combined with aromatics. When the more urgen
toms have been relieved, the discharge of the different abdomi
ecretions should be promoted by gentle laxatives, by enemata
and light nourishment may be permitted during the conva
nce.

## HOLERA INFANTUM—SUMMER COMPLAINT OF INFANTS.

is disease seems to be peculiar to the United States. It pre-
most extensively in large cities, during the hot months; and
of the most fatal affections to which childhood is subject.

occurs in children from four to twenty months of age, or
g the period of dentition; the *second summer* of children is
lered the period at which they are most liable to the disease.

commences with a profuse diarrhœa, the stools being light-
red and thin; this is succeeded by great irritability of the sto-
, so that by constant vomiting and purging the child becomes
id and prostrate, often in a few hours.

e pulse is quick, small and often tense; the tongue is white
limy; the skin is dry and harsh; the head and abdomen are
whilst the extremities are natural in temperature, or even cold.
rds evening there is fever, restlessness, and pain. Occasion-
lelirium occurs, manifested by violent tossing of the head,
pts to bite, the eyes becoming wild and injected. Death may
in six hours; but generally the case is more protracted. The
ation becomes extreme, the eyes languid and hollow, the
nance pale and shrunken, the nose sharp and pointed, the lips
lry, and shrivelled; the skin upon the forehead tight and
g. The child lies in an imperfect doze, with half-closed eye-
nsensible to external impressions.

surface of the body is now cool and clammy, of a dingy hue, and often covered with petechiæ; the tongue is dark, and the fauces dry. The abdomen becomes tympanitic; the discharges from the bowels are dark-coloured, profuse, and offensive, resembling the washings of stale meat; in other instances they may be small, and consist of mucus and undigested food.

According to Dr. Condie, "the disease is evidently dependent for its production upon the action of a heated, confined, and impure atmosphere, directly upon the skin, and indirectly upon the digestive mucous surface, at an age when the latter is already strongly predisposed to disease from the effects of dentition, and from the increased development and activity of the muciparous follicles, which take place at that period."

*Treatment.*—The most important point in the treatment is to remove the child from a heated and impure atmosphere, to the pure air of the country. A nursing child should be confined exclusively to the breast; if weaned, to tapioca, arrow-root, or ground rice, and cool mucilaginous drinks. A tepid bath should be employed night and morning; the clothing should be light and dry, and the chamber well ventilated.

The gums should be examined, and if swollen and hot, they should be freely lanced.

Small doses of calomel, acetate of lead, and prepared chalk, will be found most serviceable in arresting the diarrhœa. The irritability of the stomach may be overcome by small doses of calomel, lime-water, and milk, or a few drops of spirits of turpentine; a spice plaster, or a blister applied over the stomach, will also be decidedly advantageous.

When there is much heat about the head, with injected conjunctiva and delirium, leeches should be applied to the temples, and cold lotions to the scalp. Stimulating pediluvia, and blisters placed behind the ears, will also be found extremely beneficial.

After the irritability of the stomach is sufficiently quieted, the addition of a small quantity of ipecacuanha to the calomel, chalk, and acetate of lead, will most certainly, according to Dr. Condie, promptly restrain the disordered action of the bowels, and complete the cure.

## ASIATIC CHOLERA.

This disease has long been endemic in India. It reached Europe in the year 1831, and the following year, appeared in the United States. It returned to this country in 1834 and again in 1847–8, since when it has been more or less prevalent in certain parts of the country, and appears to have become endemic amongst us. It is, no doubt, propagated by atmospheric influence.

*Symptoms.*—There is generally a *premonitory diarrhœa*, with occasional nausea, slight cramps, and heaviness about the head.

her cases, it commences suddenly with violent vomiting and
ng (not of bile as in common cholera) but of a rice-coloured
with excessive and painful spasms of the abdominal and othe
les; the pulse is quick, small, and soon disappears altogether;
kin is cold; the features collapsed; the urine altogether sup
ed. As the vomiting and purging continue, the powers o
uickly fail; the extremities become deadly cold, and of
colour; the pulse ceases to be felt at the wrist; the breathin
orious; and the patient, who becomes very restless, is generall
d off within ten or twelve hours.

*rbid appearances.*—The blue colour of the extremities, whic
gid, remains after death. The fingers are flexed and shrunk
he nails blue. The arterial system is empty; the venous, an
ularly the right side of the heart, contains a quantity of dark
ous, and uncoagulable blood; the latter fluid is deficient i
and serum. When death has taken place rapidly, the inte
canal is most frequently pale throughout; often it presents a
ted appearance, either in spots or along continuous surface
congestion of the veins; there are no ulcerations or other signs o
nmation, but the characteristic appearance is the absence of th
elium, which often appears in shreds, looking like false mem
. The abdominal viscera are gorged with dark venous blood
he urinary bladder is empty, and contracted into a hard ball.

*ture.*—The peculiar poison seems to produce local irritation o
tomach and bowels, and at the same time, general depression
a tendency to universal exosmose of the watery portion of th
.

*eatment.*—A successful mode of treating Asiatic cholera stil
ns to be discovered. Many of the Eastern physicians strongl
mend bloodletting in the commencement of the disease, to b
ed up by calomel and opium. Others reject venesection, and
vour to allay the most prominent symptoms—viz., the irri-
y of the alimentary canal and the spasms, at the same tim
such means as are best calculated to restore the circulation t
rface of the body. This, perhaps, is the most rational mode o
nent that can be adopted; but, unfortunately, medical men are
greed upon the means. Some prescribe nothing but ice-cold
, as long as the vomiting continues; others vaunt small and
nt doses of calomel, or calomel and opium; others advise the
istration of emetics; and others again prefer stimulants, as
t oil, brandy, &c. In order to determine the blood to the
e, and allay spasm, the extremities should be assiduously
l with warm anodyne embrocations; or when the vapour o
bath can be obtained, these may be employed with advan-
Dr. Stevens speaks highly of the saline treatment, which
s in the administration of the salts of soda and potash in any

appropriate vehicle. In extreme cases, these salts have been injected into the veins with apparent advantage in a few instances. When the symptoms have subsided, and the patient survives, a stage of reaction often succeeds, and is attended with symptoms of a typhous character. The treatment should then be directed by the principles which have been laid down under the head of typhus fever.

## SECTION II.

## DISEASES OF THE RESPIRATORY ORGANS.

### CATARRH.

This term is commonly used to signify an inflammation of the respiratory passages, accompanied with a discharge. If attended with fever, it is called *catarrh fever*. When epidemic, it is termed *influenza*.

It receives different names according to the part affected, thus *coryza*, when confined to the nose and adjacent sinuses; *laryngitis*, when seated in the larynx; *bronchitis*, when in the bronchial tubes.

### CORYZA.

The inflammation is usually confined to the Schneiderian membrane, though it sometimes travels into the frontal sinuses, occasioning pain across the forehead; also into the maxillary sinus, causing pain in the cheek.

The *symptoms* are those so well known as "cold in the head." In infants it may prove dangerous from asphyxia produced while suckling; this is owing to the fact that an infant instinctively breathes through the nose; when sucking, they cannot breathe through the mouth, and the other passages being stopped up, the difficulty is occasioned. Chronic coryza is termed *ozæna*: it is attended with an offensive purulent discharge, and may be accompanied by caries, or associated with scrofula. The remedy which appears to act best is the injection of a solution of sulphate of zinc into the nostril, together with proper constitutional treatment, as iron, mercury, iodine, or cod-liver oil.

### LARYNGITIS.

Inflammation of the mucous membrane of the larynx may be of every grade, though it is usually of a mild character, and easily curable. It has been divided into the *mucous*, *submucous*, *œdematous, and pseudo-membranous forms*. The mildest form is only a

eness attended with a laryngeal cough. If more severe, there
n in the region of the larynx, increased by pressure, some
lty of inspiration, accompanied by a bronchial sound, after
secretion comes on, with an amelioration of the symptoms.
her cases, the inflammation extends to the submucous tissue,
there are some thickening and swelling obvious to the eye,
pain, or a feeling as if a foreign body were present. The
is in a very high key, and muffled; general febrile excite-
; great difficulty of inspiration, accompanied by a loud bron-
or sharp musical sound; expiration is easy. The fauces are
epiglottis turgid and erect, so as not to cover the glottis;
there is difficulty of swallowing, the drinks being often re-
d through the nose. Violent coughing comes on in paroxysms,
g which the face becomes swollen and livid, the eyes turgid
rominent, and there is more or less cerebral disturbance. The
, which is at first dry, is afterwards attended with the expec-
on of a thin and acrid secretion, which, should the case proceed
rably, becomes bland, viscous, and transparent, and gradually
es to a yellow.

ould the disease progress to a fatal termination, all the symp-
become aggravated; the mucous membrane of the larynx be-
s swollen, and the rima glottidis so contracted as not to allow
ent atmospheric air to pass to the lungs; hence there is great
œa, with violent action of the respiratory muscles. As the
becomes more contracted, the difficulty of breathing increases,
atient sits up in bed, tosses about his limbs, his eyes are pro-
t and tearful, and he dies apparently exhausted by his efforts;
a strong person, in a convulsive struggle. When the disease
nates more slowly, it is supposed that death is produced by
, which is not duly aerated, circulating in the brain.
e œdematous effusion is most apt to occur in debilitated per-

e *pseudo-membranous* variety constitutes one form of croup,
ill be noticed as a distinct disease.

*uses.*—The ordinary causes of inflammation, are especially cold,
he inhalation of noxious gases, or of very hot air, or steam.
ary angina may extend into the larynx. The submucous variety
esult from tonsillitis, and the *pseudo-membranous* form often
panies scarlatina, small-pox, and measles.

*atment.*—In ordinary cases, leeching, if the pain is severe;
tives, antimonials, low diet, rest of the voice, and warm fomen-
s. If it does not yield in four or five days, employ *mercury*
entle ptyalism, and a blister over the throat.

he worst forms of the disease, the danger is always great, and
ng should *immediately* be employed freely, but not to syncope.
es and fomentations may also be applied, and the mercurial

plan commenced earlier. If necessary, the epiglottis and margins of the glottis may be incised. Nitrate of silver has been recommended in this condition. In urgent cases, *laryngotomy* is to be employed as the only resource; but it will be of little use if too long delayed, or if the disease has extended down into the bronchi.

## CHRONIC LARYNGITIS.

This may be of every grade. It may proceed from repeated attacks of the acute form; from follicular inflammation of the throat, accompanied by a scrofulous diathesis; and from ulcerations connected with syphilis or tuberculosis. The common cases usually recover; the *ulcerations* often terminate unfavourably.

*Symptoms.*—Hoarseness and constant clearing of the throat. If more severe, partial or complete aphonia. *Ulceration* is indicated by a sharp pricking pain on speaking or coughing; occasionally there is dysphagia; also suffocative paroxysms. Sometimes the cough is loose, with a muco-purulent discharge.

A fatal termination is often given to it by its ending in phthisis.

*Treatment.*—Absolute rest of voice; diet according to the strength; occasional leeching to the throat; pustulation with croton-oil; together with a mild mercurial course.

In the *scrofulous* form, iodine or iodide of potassium and cod-liver oil would be indicated; in the *syphilitic* variety, mercury and iodine would be useful. The *direct* application of a strong solution of nitrate of silver (ʒss up to ʒij to f℥j of water), by means of a probang, around, and even within the glottis, is a most valuable remedy.

Before entering further into a description of the diseases of the respiratory apparatus, a tabular view of the thoracic regions, in relation to the signs of auscultation, &c., and based upon that occurring in *Meade's Manual for Students*, is presented to the reader.

REGIONS OF THE CHEST.—(Figs. 1, 2, 3.)

| | | | |
|---|---|---|---|
| *a.* Anterior. | 1. Supra-clavicular,<br>2. Clavicular,<br>3. Infra-clavicular,<br>4. Mammary,<br>5. Infra-Mammary,<br>6. Upper sternal,<br>7. Lower sternal. | *b.* Posterior. | 8. Upper scapular,<br>9. Lower scapular,<br>10. Infra-scapular,<br>11. Inter-scapular. |
| | | *c.* Lateral. | 12. Axillary,<br>13. Infra-axillary. |

TABULAR VIEW OF THE THORACIC REGIONS, IN RELATION TO THE SIGNS OF AUSCULTATION, ETC., MODIFIED FROM MEADE'S MANUAL.

(See Figs. 1, 2, 3.)

| REGIONS. | FIG. | SITUATION. | NATURAL SOUND ON PERCUSSION. | INTERIOR CORRESPONDING PARTS. | SIGNS MOST COMMONLY PRODUCED THERE BY DISEASE. |
|---|---|---|---|---|---|
| 1. Supra-clavicular. | 1 | | Clear. . . . | Apices of the lungs. | Dulness on percussion in phthisis; generally most on one side. |
| 2. Clavicular. | 1 | Clavicles. . | Very clear towards the sternum; clear in the middle; dull close to the humerus. | | |
| 3. Infra-clavicular. | 1 | From clavicle to the fourth rib. | Very clear. . . | Superior lobes of the lungs. | Irregular dulness on percussion, diffuse bronchophony, impaired respiration, and afterwards, cavernous rhonchus and pectoriloquy, in phthisis. |
| 4. Mammary. . | 1 | Between the fourth and eighth ribs. | Very clear; particularly by mediate percussion. In women, a clear sound can be obtained through the mammæ only by mediate percussion. | Middle lobes of the lungs; large bronchi in the upper part, near the sternum; the heart generally covered by the lungs, in the lower part of the left region. | Rhonchi in catarrh; more rarely phthisical symptoms. On the left side, dulness on percussion in hydropericardium and enlargement of the heart; increased impulse in hypertrophy, and increased sound of pulsation in dilatation of the heart; constant bellows or rasp sound in valvular disease. |
| 5. Infra-mammary. | 1 | Between the eighth ribs and the margin of the cartilages of the false ribs. | Dull on the right side; on the left irregularly dull, or unnaturally resonant. | The liver on the right, and the stomach on the left side, covered only on the upper part by the thin margin of the anterior inferior | Crepitant rhonchus in incipient pneumonia. Extinction of respiration in advancing pleurisy. Dry crepitation in interlobular emphysema. |

| | | | | | |
|---|---|---|---|---|---|
| **6. Superior sternal.** | 1 | **Upper two-thirds of the sternum.** | **Very clear.** | **Large bronchi.**<br>**Margins of the middle lobes of the lungs.** | **Bronchial rhonchi in catarrh. Only half the sternum dull on percussion in hepatization, the whole dull in extensive liquid effusion, of one side.** |
| 7. **Inferior sternal.** | 1 | Lower part of the sternum and ensiform cartilage. | In the upper part clear; rather less so in fat persons. Below, sometimes more dull; sometimes tympanitic. | Above, margins of the lungs; below, the heart, liver, and sometimes the stomach. | Signs of diseases of the right side of the heart; dulness on percussion in effusion, or fat, in the pericardium, enlarged heart, &c. |
| 8. 9. **Scapular.** | 2 | The scapula and the muscular ridge below them. | The pectoral resonance can be elicited from this region only by mediate percussion. | Middle posterior lobes of the lungs. | Catarrhal signs. Ægophony in pleurisy. Bronchophony in pneumonia. |
| 10. **Infra-scapular.** | 2 | Below the inferior angles of the scapulæ and border of the serrati, to the level of the 12th vertebræ. | Clear on the upper portion, by striking on the angles of the ribs, or by mediate percussion. Below, dull on the right, and tympanitic on the left side. | Base of the lungs. The liver encroaches on the right, and the stomach on the left side. | Crepitant rhonchus and bronchophony in incipient pneumonia and œdema; ægophony in pleurisy; and dulness on percussion in both. |
| 11. **Inter-scapular.** | 2 | Between the inner margin of the scapulæ. | Pretty clear by mediate percussion, or when the arms are crossed, and the head bowed forwards. The spinous processes of the vertebræ sound well. | The roots, and inner parts of the posterior lobes of the lungs. | Catarrhal signs. In the upper part, sound of respiration never destroyed in effusions into the pleura. In the lower portion, sometimes ægophony in pleurisy, crepitation and bronchophony in advancing pneumonia. Signs of diseased bronchial glands. |
| 12. **Axillary.** | 3 | In the axillæ above the fourth ribs. | Very clear. | Upper part of the lateral lobes of the lungs. Large bronchi. | Dulness on percussion, cavernous rhonchus, pectoriloquy, &c., in phthisis. Catarrhal rhonchi. |
| **fra-axillary.** | 3 | Between the fourth and eighth ribs at the sides. | Very clear: unnaturally so, in emphysema of the lung. | Middle of the lateral lobes of the lungs. | Dulness on percussion in advanced pleurisy; and on the right side, from enlarged liver. Ægophony **in advancing pleurisy; crepitant rhonchus, and bronchophony in advancing pneumonia.** |

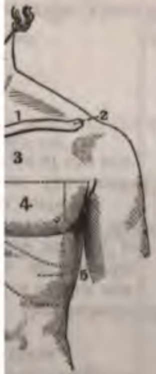
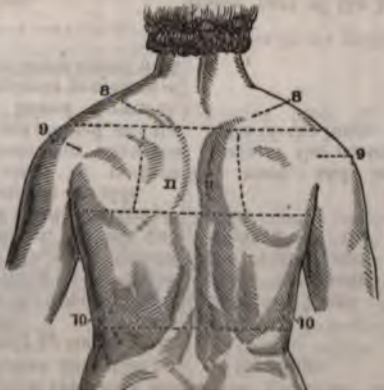
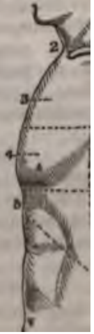


Fig. 2.





## BRONCHITIS.

Inflammation of the bronchial mucous membrane occurs of every grade, from a slight cold up to a very dangerous disease.

*Symptoms.*—In a decided case, there is a sense of constriction of the chest, rather than of acute pain, increased by coughing; respiration more or less hurried; the cough is at first dry and painful, after which expectoration commences, at first, of a clear tenacious mucus, and afterwards becoming opaque, more abundant, and purulent. There is more or less fever. Usually all the painful symptoms abate on the appearance of expectoration, and convalescence is established in the course of a week or ten days; but it may run into the chronic form.

In more severe cases, the symptoms are much more intense. There is great difficulty of inspiration, attended with a wheezing sound, occasioned by a narrowing of the calibre of the tubes from effusion: the cough is more painful; there is greater soreness of the chest, together with increased fever. There are presented signs of a deficient aeration of the blood, such as a purplish appearance of the face and the extremities, cool skin, &c. This latter condition is very apt to come on in children, from the inflammation running down into the smaller bronchial tubes and often completely stopping them up; it is then sometimes called *capillary bronchitis*, and is attended with considerable danger. In the very aged it is also apt to prove fatal. Sometimes it assumes a paroxysmal, spasmodic character, when associated with asthma; again, it may be complicated with pseudo-membranous effusion, which however is rare in adults, though occasionally found in children, in whom it is very apt to prove fatal.

In adults, the disease is apt to be more circumscribed.

Another form of bronchitis, known as the *asthenic*, or *peripneumonia notha*, or *suffocative catarrh*, occurs in aged and enfeebled persons, though sometimes as an acute affection in the young. There is a sudden congestion of the whole bronchial mucous membrane, causing excessive dyspnœa, and a very copious expectoration of a thin and often bloody mucus, which causes suffocation.

*Diagnosis.*—Bronchitis may be confounded with pneumonia, pleurisy, laryngitis, and phthisis. Generally, however, the rational signs are sufficient to distinguish them; if not, the *physical* signs will always point it out. *Percussion* is clear throughout the chest, except in cases of great congestion, when there may be some dulness. *Auscultation* reveals very obvious changes. The three characteristic sounds are, 1, the *sibilant rhonchus*, if the disease is seated in the smaller tubes; 2, the *sonorous rhonchus*, if in the larger tubes; 3, the *mucous rhonchus* commingled with the others, heard as the disease advances, and as expectoration commences.

Occasionally, the subcrepitant and submucous rhonchi may be heard, if there is commencing pneumonia. In certain cases, where one of the larger tubes happens to be plugged up with mucus, no sounds may be heard over that portion of the lung, but percussion will reveal a clear sound, showing that it is not pneumonia; in such a case, if the patient be directed to cough, the usual sounds will return.

*Causes.*—Cold is the most frequent cause; the inhalation of irritating gases, or of hot air; also epidemic causes, and a gouty or rheumatic tendency. It is a frequent accompaniment of other diseases, as measles, enteric fever, hooping cough, small-pox, scarlet fever, and nearly all the pectoral diseases, especially pneumonia and phthisis. It may also arise from cardiac disease, causing congestion of the pulmonary vesicles.

*Of the Sputa in Bronchitis.*—In the first stage of bronchitis, the cough is dry, and so long as it continues so, the bronchitis must be considered as still at its commencement. At the end of a time, the length of which varies according to individual peculiarities, and according as the patients are or are not subjected to proper treatment, each fit of coughing is followed by the excretion of a clear, transparent, serous or watery mucosity, which is at first slightly saline, but afterwards becomes tasteless. As the disease advances, the matter expectorated is a glairy mucus, like white of egg; when it is poured from one vessel into another, it is observed to flow in one mass of extreme tenacity.

When the patient is attacked with violent fits of coughing, accompanied by considerable heat within the chest, as also by marked distress and general anxiety, the expectorated matter acquires remarkable viscidity, and resembles a little the jelly-like sputa of acute pneumonia. When the bronchial inflammation is accompanied by much fever, the viscidity of the sputa becomes also greater during the febrile paroxysm, so much so, that an inexperienced practitioner may mistake it for that of pneumonia; on the cessation of the paroxysm, however, the sputa will be found to have lost their viscidity. At other times, every species of expectoration is suppressed during the paroxysm; which indicates an increase of irritation of the mucous membrane. Some patients present, towards the end of the perspiration which terminates the paroxysm, a copious expectoration of thick, opaque sputa, such as is observed in the last stage of bronchitis; but this is only a temporary state, and the patient soon expectorates anew a clear limpid mucus, as before the febrile exacerbation. The sputa, in this stage, are frequently marked with some streaks of blood, arising from small vessels which are ruptured in the midst of an effort to cough. The blood is then *mixed* with mucus, but it is not *combined* with it, as happens in the reddened sputa of pneumonia. It often happens that in the midst of the transparent mucus, there are found, in greater or less numbers, small clots of a dull white; they do not come from the lung, but appear to be secreted in the pharynx and posterior part of the mouth, by the numerous crypts with which the mucous membrane of these parts is supplied. These clots have been erroneously considered as portions of pulmonary tubercles, and consequently as one of the pathognomonic signs of phthisis.

As long as the sputa present the appearance above described, the symptoms of bronchial irritation do not improve; but according as the inflammation proceeds towards resolution, the sputa change their character. The mucus which forms them gradually loses its transparency; it is mixed with opaque, yellow, white, or greenish masses, which, scanty at first, continually increase, and ultimately constitute the entire sputa. Such an expectoration is ordinarily accompanied by marked remission in the different symptoms of bronchial inflammation.

*Treatment.*—The disease may sometimes be aborted, *at its very commencement*, by a full dose of opium, or Dover's powder taken at night, or by a copious draught of hot infusion of Eupatorium; but such a plan of treatment is not without some risk, on account of the liability to relapse on exposure. As a general rule, opium is not proper in the early stage, because it checks the bronchial secretion. In mild cases, confinement to a warm room, low diet, a saline cathartic, and some demulcent drink will usually suffice. In more severe cases, it will be proper to bleed, and purge, and employ the antimonials. For young children, the syrup of ipecacuanha is preferable to antimony. Cups and leeches are often required, either alone, or as adjuvants to the lancet. As the disease advances, the more stimulating expectorants will be useful, as the syrup of squill or seneka, to which opium, in some form, may be added, if expectoration is established.

*Emetics* are often of signal service in the bronchitis of infants; ipecacuanha should be preferred. A large warm poultice of Indian mush (to which a little mustard may sometimes be added), is very useful, especially for children.

If the disorder does not yield in the course of a week, the mercurial plan should be adopted, and a blister applied over the chest, or between the shoulders.

After the subsidence of the excitement, leaving only an irritation with oppression and expectoration, the condition of the bronchial membrane is different; it is now relaxed, and requires to be stimulated. The more stimulating expectorants are now called for, as myrrh, ammonia, carbonate of ammonia, and the balsams; at the same time the diet should be improved, and wine-whey and porter allowed. Such a condition often comes on in infants, and, if not properly treated, it is apt to end fatally. It is generally indicated

ldness of the surface, especially of the cheeks; whenever it
, the syrup of garlic, or assafœtida, and a nourishing diet
l be directed. The tincture of garlic, rubbed frequently ove
hest, will be found an excellent application to children of en
d general health.

cases of sudden congestion it is necessary to bleed largely
generally and locally.

## CHRONIC BRONCHITIS.

is disease may arise from repeated attacks of the acute form
nay last for years. In many of its symptoms it strongly re
les phthisis, for which it was formerly often mistaken, fro
of proper means of diagnosis.

e *physical signs* are the sonorous, sibilant, and mucous rhonchi
throughout the chest, and the absence of the signs of chroni
isy, chronic pneumonia, and phthisis.

*eatment.*—In the aged, in whom it has become habitual, i
be hazardous to arrest the discharge; hence the importanc
imely attention to it. General bleeding is very seldom nece
occasional cupping or leeching will often be beneficial. Th
reliance is upon the stimulating expectorants, one of the bes
nich is seneka, which may be combined with ipecac., or tarta
c in minute doses. Still later, ammoniac, the balsams, a
ba and Tolu, and the terebinthinate preparations, will prov
l; and, if there are nervous symptoms, assafœtida and garlic
ant counter-irritation should be kept up over the chest, b
s of repeated blisters, tartar emetic ointment, croton oil, o
plasters. The remedy, however, mainly to be relied on, is
e but protracted mercurial impression. Inhalations of th
r of tar, chlorine, and iodine are often of benefit. Tonics ar
ed in debilitated cases, together with a nutritious diet, warn
ng, and out-door exercise, and in some cases, cod liver oil
, and change of air.

## CROUP.

e essential character of this disease is a combination of an in
ation of the larynx, and a spasmodic action of the muscles
the glottis. *Mere spasm* is not croup.

ere are two distinct varieties, the catarrhal and the pseudo
ranous; the former a very curable disease, the latter a ver
ne. The English writers do not recognise the catarrhal va

*arrhal croup.*—The symptoms are similar to those of catarrh,
ten precede the spasm; there may be a *croupy cough* for some

time previous. The paroxysm comes on suddenly at night, the child awaking with the characteristic sound, consisting of the peculiar cough, combined with a shrill inspiration. This may continue for some time, with great restlessness, jactitation, and distress. After a time the skin becomes cool, the pulse feeble, the face purple, and general relaxation; the paroxysm now usually gives way, leaving behind a febrile condition. The paroxysm may, however, return again the following night, and so continue for some time, or it may subside spontaneously. It may prove fatal, either by producing asphyxia in the paroxysm, or from the supervention of bronchitis, accompanied by excessive expectoration. It generally depends on a simple laryngitis.

In the *pseudo-membranous* form, the early symptoms may be those of catarrhal croup; or they may be, from the first, of a peculiar character, the little patient going about with a muffled cough and voice, which, after a while, become entirely suppressed; this is an extremely dangerous symptom, as it arises from the exudation of the false membrane, which can be frequently seen on inspection of the throat. In favourable cases, the character of the secretion changes, becoming mucous; this occasions a loosening of the exudation, which may be then thrown off in a tubular form.

The cough, which was at first dry, or attended with a scanty muco-sanguineous expectoration, now becomes husky and suffocative, and is frequently attended with abortive efforts to excrete what is felt in the trachea; the sense of suffocation is increased, and the fits of coughing are accompanied by the expectoration of a glairy mucus, containing shreds of the adventitious membrane. As the disease advances, there is total absence of any distinct remissions; the pulse becomes accelerated, small, weak, and irregular; and the cough is less frequent, less audible, but suffocative. If a fatal termination is approaching, the patient tosses about in great distress; seizes on objects around him, and grasps them convulsively for a moment; throws his head back; seizes his throat, as if to remove some obstacle to respiration; makes forcible efforts to expand the lungs; and, after a variable duration of such sufferings, seldom above twenty hours, dies, either with signs of convulsive suffocation, or those of complete exhaustion of vital energy. Such is the course of the severe form of croup, when left to nature, or when unchecked by treatment.

The cause of the peculiarity of this form of croup is probably to be looked for in the blood. It very rarely attacks a child under one year of age; and it may be that, after this period, the blood becomes more plastic in its character, causing a tendency to the fibrinous exudation. Certainly, it cannot be owing to any violence in the inflammation, since this is often scarcely noticeable. The membranous effusion often extends down to the ramifications of the

hi. Sometimes it begins in the bronchi and extends up
s.

eatment of *catarrhal croup.*—In the paroxysm, give an emetic
ich the dose must be larger than common; the best is tarta
c; a quarter of a grain is the dose for a child two years old
ild cases ipecacuanha will be sufficient. Repeat the emeti
ten or fifteen minutes till it operates, and at the same tim
y the warm bath. This treatment is to be repeated if th
does not yield; after which bleeding or leeches. If the spas
relaxed by this mode of treatment, a tobacco cataplasm ma
t around the throat, and its effects carefully watched. Th
ning catarrh is to be treated by a dose of calomel, and smal
of the nauseating expectorants, as syrup or wine of ipecac

In the more advanced stages, seneka, or *Coxe's hive syru*
be employed. Counter-irritation should be used at the sam
and if inflammation remain, small doses of calomel. I
ity, use carbonate of ammonia.

e treatment of the *pseudo-membranous* form is essentially th
as the foregoing, only more decided, with the addition o
hing to correct the plasticity of the blood; mercury is th

After bleeding or leeching, give a purgative dose of calomel
fterwards one grain every hour. The *alkalies*—especially car
e of potassa—have been highly recommended with the sam

great debility, stimulants must be employed, as carbonate o
nia, wine whey, &c., together with the most stimulatin
torants. To favour the expulsion of the false membrane
pt and vigorous emetics should be occasionally employed,—
as will not prostrate the system, as sulphate of zinc or sulphat
pper, or, what is better than either, alum in teaspoonful doses
nded in molasses or honey. *Tracheotomy* is resorted to whe
her means fail.

### SPASM OF THE GLOTTIS,

*spasmodic croup*, as it is sometimes very improperly called, is
lifferent from the preceding disease. It consists in a sudden
g fit, caused by a spasm of the muscles that close the glottis.
is no fever, nor any morbid appearances about the throat;
sorder is purely functional. It occurs in children, especially
the irritation of teething or weaning. The child suddenly
ts breath, tosses up its arms, turns bluish about the mouth,
hen it recovers its breath makes a long crowing inspiration.
omplaint is often fatal.

ing the fit, the best remedy is to sprinkle a little cold water
child's face; in the intervals the bowels must be opened,

the diet rendered light and digestible, and the child put into the best possible state of general health. Very small doses of prussic acid with an alkali are sometimes of service.

## PERTUSSIS—WHOOPING-COUGH.

This affection is contagious; it seldom occurs twice in the same individual, and particularly attacks children; but adults are liable to it, if they have escaped it in their childhood.

*Symptoms.*—It commences with symptoms of common *cold*, or *catarrh*, which may last for some days; the cough then becomes convulsive, and recurs in fits at various intervals. The fits may last a quarter of an hour or more. Each fit is composed of a quick succession of sonorous coughs, with scarcely any perceptible inspiration between; but at intervals the expirations of coughing are suddenly interrupted by a very deep, sonorous inspiration, or *whoop*, which constitutes the pathognomonic sign of this disease. The peculiar whooping inspiration depends on spasm of the glottis. The face becomes swollen and livid in the paroxysm, and particularly during the whooping. The fit terminates by the expectoration of a colourless and scarcely frothy phlegm, and in many cases by vomiting also. The paroxysms at first recur several times every day, being always more severe towards evening, but less so during the night. After a certain time, they only return in the morning and evening; and towards the end of the disease, in the evening only. The duration of whooping-cough varies from a few weeks to several months. Before it terminates, the paroxysms become shorter, lose their peculiar characters, and are attended by an expectoration more decidedly mucous. This disorder may be complicated with bronchitis, or pneumonia; which are the chief sources of danger:—or it may cause cerebral symptoms, or sometimes a real apoplexy. The younger the child, the greater the danger. In some cases, the disease degenerates into a chronic mucous catarrh, with emaciation, and other symptoms resembling phthisis. In the intervals of the paroxysms, the patient coughs but little, preserves his appetite and strength, and has rarely any fever, except in the case above mentioned, or in the onset of a very severe attack.

*Physical signs.*—In the intervals of cough, the respiratory murmur varies on different points of the chest; at one part it is lost; at another it is slight; at a third it is puerile: there is some degree of *sibilus* and *crepitus*. The sound of the chest, on percussion, is good and unimpaired. The lungs do not become inflated during the strong inspiratory effort producing the whoop; for not only is the rima glottidis spasmodically affected, but in all probability the whole of the ramifications of the respiratory tree participate in this morbid action; for, during that period, if the ear is applied to the no rhonchus or respiratory murmur is heard, except for a it between each cough. The great tendency of pertussis in children to pass into pneumonia, œdema pulmonum, or in- bronchitis, makes frequent auscultation of the chest very ary.

he first invasion, this disease may be mistaken for croup, o tive catarrh.

*bid appearances.*—The most probable theory of the nature o ing-cough is, that it is a peculiar irritation of the laryngeal ies of the *par vagum.* When it terminates fatally, it i upon the supervention of peripneumonia or œdema pulmo in the first case, the lung will be found to contain sanguino rum, and here and there a lobule hepatized; in the second, e quantity of highly spumous and colourless serum follow alpel on section of the pulmonary tissue. In some cases, th ges of the brain are much injected; in rare instances, ther some effusion.

*atment.*—In the early, or *catarrhal* stage, a purge shoul ven, followed by syrup of ipecacuanha; if the bronchiti ere, leeches and the other means are to be used, already men . In the second, or *nervous* stage, the indication is to equaliz is action, and relax the spasm; the antispasmodics and nar are the remedies; assafœtida is especially useful, also bella and hydrocyanic acid. *Alum,* in doses of one or two grain times a day, is highly spoken of by Dr. Meigs. Frictions o amber, tincture of garlic, &c., to the spine, are also very usefu juvants. The Germans recommend a combination of carbo f potassa and cochineal.

the advanced period, tonics, as quinia, sulphate of zinc, an f there is anemia, together with change of air, should b yed. *Vaccination* is said to render the disease much milder.

## SPASMODIC ASTHMA.

hma is caused by a spasm of the muscular fibres encircling th hial tubes, and especially the smaller ones.

existence of these muscular fibres was proved by Reisseissen as been confirmed by Dr. Williams, Valentin, and others ave produced contraction of them by galvanism.

*exciting* causes of the purely spasmodic variety of asthma ar which impress the nervous system, as strong or peculiar odours l emotions, and particular states of the atmosphere, and espe irritation of the stomach and bowels.

*precursory* symptoms of asthma are, languor, sickness, flatu and other dyspeptic symptoms; heaviness over the eyes adache; uneasiness and anxiety about the præcordia, with sense of fulness and straitness in this region and in the epigastrium. In some cases pain is complained of in the neck, with unusual drowsiness and stupor.

*Symptoms.*—The attack of spasmodic asthma takes place generally about one or two in the morning, and during the first sleep. The patient suddenly awakes with a sense of suffocation, great tightness at his chest, difficulty of breathing, and excessive anxiety; he assumes with great eagerness the erect posture, and cannot bear the least incumbrance about the chest. The respiration is wheezing, interrupted, and laborious; the shoulders are raised, the elbows directed backwards, and every effort made to enlarge the thorax. The countenance, which was at first pale and anxious, becomes, especially in plethoric habits, suffused or bloated, and covered with perspiration. A considerable quantity of pale urine is voided at the commencement, or previous to the accession, of the paroxysm; and the lower extremities are usually cold. The pulse is generally quick, weak, and somewhat irregular. During the fit the patient has commonly an instinctive desire for cool air. When the fit has continued from half an hour to one, two, three, or even four hours, some degree of cough and expectoration comes on, which relieves the patient; and after a brief period, his respiration, pulse and feelings assume their natural state.

Such is the common course of a first and moderate attack of this disease. Occasionally the patient has but one such fit, but more generally a slight constriction of the chest is felt through all the succeeding day, and the paroxysms return at the usual period of the night; this may occur for several nights, and at last the patient is altogether released from the attack. The disease may be suspended for several months, but it is liable to recur from changes of air, errors of diet, and the operation of other causes.

*Physical signs.*—In spasmodic asthma, during the fit the chest does not sound well on percussion, and the respiratory murmur is indistinct, even on the most forcible inspiration. But if the patient, after holding his breath a short time, be desired to breathe again quietly, the spasm will be for a moment overcome, and the entry of air into the cells will be heard in a clear and sometimes puerile sound; after one or two inspirations, the spasm again comes on, and the respiration becomes as dull as before.

In treating of the pathology of this disease, it was stated that the muscular fibres were in a state of spasm during the paroxysm; the obstruction to the entrance of the air into the small bronchi and vesicles thus produced is obviously the cause of the diminution of the respiratory murmur. By this contraction also the lungs are in a manner collapsed within the chest, and the parietes of the thoracic cavity, pressed by the atmospheric weight on them, lose that sonorous elasticity produced by a fulness of their aerial contents.

*nplicated asthma.*—A pure spasmodic asthma, affecting lun vise healthy, is by no means common. In general there i disease of the heart, or some chronic bronchitis acting as of permanent congestion, which both adds to the difficulty c ing, and predisposes the parts to be more easily affected wit spasm.

netimes a severe attack of *dry catarrh* is aggravated by spasm onstitutes the *bronchial asthma* of Andral.

*rbid appearances.*—The changes which have been notice ose who have died of asthma are to be regarded chiefly a ntal occurrences, or associated maladies, and, perhaps, mor ently, as the remote results of repeated or protracted attack sions sufficient to account for the phenomena of *uncomplicate* a, could be detected by Laënnec, Andral, Cruveilhier, Bouil and many other investigators. The most common cons es of the disease are, chronic inflammation and dilatation o onchi; the different varieties of emphysema and œdema of th ; hæmoptysis; tubercular deposits, with which asthma ma ociated from its commencement; hypertrophy and dilatatio cavities of the heart; atrophy of the heart; effusions int ericardium; effusions into the pleura; and, in some sever congestions or effusions within the head, giving rise to coma oplexy.

*eatment.*—The indications during the interval are, to strengthe eneral health and avoid all derangement of the stomach by im r diet, and irritation of the lungs by unwholesome air.

e treatment of the fit consists in administering narcotics an asmodics. These should be given, if possible, as soon as th *ensations* are felt, and then they may avert the attack; and i iced, that those do most good which produce expectoration g coffee; laudanum and ether; and stramonium smoked a o, are the most trustworthy. Inhalations of ether or chloro are often very effectual, but should be used with caution, an in cases of congestion, or where there is a gouty tendency, o c disease. The same remarks apply to the smoking of stra m.

acuanha first given in an emetic dose, and afterwards in smal ties, so as to keep up a constant nausea, sometimes has ful effect on spasmodic asthma. The tincture of *lobelia inflat* n tobacco) is much used in asthmatic cases given in doses o ry half hour; it is nearly allied in its operation to stramoniu bacco, and often succeeds in checking the paroxysm whe shortly before its invasion. Bloodletting is only required i s inflammatory complication. If of a gouty character, th f colchicum should be given to nauseate.

he interval, the treatment consists in attending to the patient' l health.

## PNEUMONIA.

This is an inflammation of the parenchyma of the lungs. Three well-marked stages of the disease are exhibited, marked by characteristic pathological conditions of the organs.

The *first* stage is that of engorgement or congestion; the lung is reddened, is more dense, with occasional slight effusion, but no consolidation; air still penetrates its vesicles; it floats upon water, and crepitates on pressure. When pressed, a frothy serum exudes.

The *second* stage, or that of *hepatization*, is characterized by a still greater congestion and effusion into the vesicles and smallest bronchial tubes, and into the areolar tissue; the matter effused is either blood or fibrine. When cut open, the lung has a granular appearance, and is consolidated; it sinks in water, does not crepitate on pressure, and when pressed, emits a bloody serum. The transition of the first into the second stage is gradual and partial.

The *third* stage is that of *suppuration;* called, also, *gray hepatization*. The colour of the lung is a grayish-yellow; it is still solid and smooth; the effused matter is converted into pus. Portions of the same lung may be, at the same time, in the second and third stages. If the suppuration be circumscribed, it constitutes a *pulmonary abscess;* and inasmuch as very extensive suppuration would destroy life *before* the formation of an abscess, by the complete disorganization of the tissue, the occurrence of pulmonary abscess is not to be regarded as a very dangerous sign.

In asthenic cases the disease cannot advance beyond the first stage before softening occurs,—the whole tissue being reduced to a pulpy mass, termed *splenization*.

Pneumonia may be single or double; in other words, it may attack but one lung or both at the same time. In one and the same lung it may be general or partial, attack the upper or lower lobe, be confined to the base, the root, or the centre (*lobular pneumonia*). It has been said, that all these different seats of pneumonia have been equally frequent. Some numerical results will settle the question. Out of two hundred and ten pneumonias, there were—

| | |
|---|---|
| On the *right* side . . . . . . . . | 121 |
| " *left* side . . . . . . . . | 58 |
| Both sides (*double*) . . . . . . . . | 25 |
| Cases where the seat could not be detected . . | 6 |

Another form is named *lobular pneumonia*, where numerous little distinct spots, supposed to be lobules—are affected; it is usually the result of bronchitis, and is generally met with in children. Each lobule will run through all the three stages, hence abscesses are not uncommon in this form of the disease.

of the adherent walls of the vesicles in inspiration, and resembles that caused by rubbing a lock of hair between the finger and thumb close to the ear. This sound indicates engorgement of the lung; whilst it exists, it is a proof that in several points at least, the inflammation has not passed the first stage. As long as the natural respiratory murmur predominates over the crepitation, we should infer that the inflammation is slight; on the other hand, when the crepitation prevails so as altogether to mask the respiratory murmur, it is a certain indication that the pneumonia has made progress, and that it has a tendency to pass to the second stage. These phenomena soon change, either by the resolution of the disease, or by its making further progress. In the former case, the crepitation diminishes in extent and intensity; the murmur of respiration approaches its natural state; the sound of the chest becomes less dull, and its movements more regular.

*Second stage.*—The second stage of pneumonia is that in which the lung presents that change which is called by Laennec *red hepatization.* In this condition, the cells being obliterated, while the large tubes remain pervious, dulness on percussion, bronchial respiration, and a loud resonance of the voice (*bronchophony*), are produced; the extension or intensity of these signs furnishes, within certain limits, an accurate measure of the extent or intensity of the disease. The *bronchial respiration* specifically marks the second stage of pneumonic inflammation; often, at the same time, the crepitant rhonchus may be heard in the adjacent parts.

If the patient recovers from the second stage, and the infiltration diminishes, so that the air is again admitted to the minute tubes and vesicles, this is announced by a return of the *small crepitation,* which is of course favourable.

*Third stage.*—In the *third* stage, the diseased lung becomes infiltrated with a purulent matter, which is generally consistent at first, but soon acquires the liquidity of common pus. In this stage, a peculiar muco-crepitating rhonchus is heard, at first in some points, then in the whole of the affected part. It is usually announced by the recurrence of the chill, and the expectoration of a "prune juice" sputum.

Convalescence commences by the end of the first week, if the disease has not progressed beyond the first stage; at the end of the second or third week, if it has advanced to the second stage; and, if it has proceeded to the *third* stage, the period of recovery will depend altogether upon the strength of the constitution, and the amount of tissue involved.

When an *abscess* forms in a hepatized lung, the passage of air through the liquid will be indicated by the gurgling or cavernous rhonchus; and when the cavity has been emptied of the pus by expectoration, pectoriloquy and the cavernous respiration will be added to this sign.

(Rasori,) is by large doses of tartar emetic in the early stage, commencing with one-quarter of a grain, every hour, and gradually increasing up to one grain. This plan may prove effectual, but there is risk of producing gastro-enteritis, and of deteriorating the blood.

In *bilious pneumonia*, the only modification of the treatment is to commence with the mercurial plan immediately, along with the bleeding.

In the *miasmatic* form, quinia should be given in the apyrexia.

In *typhous pneumonia*, general depletion is inadmissible; cupping and blistering may, however, be employed; and especially the early use of *mercury*, combined with opium and ipecac., and the timely resort to carbonate of ammonia and wine.

*Chronic pneumonia* is to be treated by moderate topical depletion, blisters, and a mild protracted course of mercury.

### PLEURITIS, OR PLEURISY.

*Symptoms.*—Fever, acute pain in the side, hurried and interrupted respiration, *dry* cough, and a hard resisting pulse, are the marked symptoms of this disease in its early stages. The pain is often intense, all motions of the thorax increase it, and the affected side is fixed and motionless. The patient complains of intense heat within the chest, and there is occasionally an extreme tenderness of the integuments. The pain is usually felt below the breast; but it may be felt in the shoulder, the axilla, the lumbar region, or lower portion of the right hypochondrium. Sometimes the pain is wandering and fugitive, and it is not till the lapse of some days that it becomes fixed and continued. In this case it is often taken for a mere rheumatic pain. The pain, after continuing for forty-eight or sixty hours, in general diminishes or ceases altogether; and this coincides with an effusion. But in some severe cases the pain continues, with slight remissions, long after copious effusion has occurred, or even remains unabated up to the period of death. Sometimes, after having disappeared, it shows itself anew with great violence; this is a sure sign of the return of the inflammation. During the first stage, the patient seldom lies on the affected side, in consequence of the position causing increase of pain. The rule generally is, that in the first stage he lies on the healthy, in the second, on the diseased side. When the diaphragmatic pleura is affected, there is generally orthopnœa; as might be expected, the respiration is more hurried and difficult during the persistence of the pain.

*Anatomical changes.*—The first effect of inflammation of the pleura is a diminished secretion, producing dryness of the membrane; and the first visible alteration is redness. Very soon *effusion* comes on, which may be either purely serous, or, occasionally, fibrinous in its character, without serum, constituting the *dry* *pleurisy* of writers; or most frequently a combination of the two. At first, the fibrinous effusion is in the form of a thin, delicate layer, which soon becomes thicker in spots; of a bloody colour, and occasionally exhibited in the form of shreds, connecting together the two opposite pleural surfaces.

The serous effusion may soon become so considerable as almost to fill the thorax, and to occasion displacement of the viscera; this, however, is rare in the acute stage, though more common in the chronic form. The effusion, if considerable, occasions great compression of the lung, which is found flattened against the posterior walls of the thorax. Should the recovery be rapid, it may happen that all the effusion may disappear by absorption; but generally, adhesions between the opposing pleural surfaces are contracted, which are permanent. This may occur very speedily, if the effusion has consisted exclusively of coagulable lymph; but a longer time is requisite if any serum is interposed. Not unfrequently, *contraction of the walls of the chest* is the result of such adhesions; and long filaments of false membrane are observed stretching between the pulmonary and costal pleura. The fluid portion, moreover, may be retained in little isolated spots, being surrounded with the organized membrane.

In chronic pleurisy, the effused matter may consist, either partially or chiefly, of pus. The quantity of fluid is usually much greater than in the acute stage, and the compression of the lung proportionally decided. *Empyema* is the name given to collections of pus in the cavity of the thorax. The pus sometimes makes its way into the bronchial tubes, producing *pneumo-thorax*, or it may take an external direction.

*Physical signs.*—The earliest sign of pleurisy, occurring during the first stage, when the membrane is slightly roughened by lymph, is a *rubbing sound* heard during the movements by inspiration, and arising naturally from the friction of the roughened surfaces against each other. This sound is often perceptible to the patient himself. But it ceases as soon as the opposing costal and pulmonary membranes are separated by liquid effusion.

When effusion has occurred, it is denoted by dulness on percussion of the portion of the chest corresponding to the effusion. This dulness, supervening much more rapidly than in ordinary pneumonia, and unaccompanied or preceded by crepitation, generally points out pleuritic effusion. The resonance of the chest is commonly diminished first in the inferior dorsal and lateral regions, corresponding to the base of the lung. As the infusion increases, the dulness of sound gradually extends upwards, and becomes more pronounced. Sometimes the transition from the dull to the healthy sounding parts is so abrupt that a horizontal line will exactly divide them, and this, when well marked, is a very characteristic sign. A change of position will also alter this line in a manner quite distinctive, and, what can happen only in liquid effusion,—the dull sound always accompanies the liquid as it gravitates to the lowest parts. When the effusion is copious, the entire side, from the clavicle down, may be dull. M. Reynaud has pointed out another effect of effusion, which may furnish a diagnostic sign, in its intercepting the slight fremitus or vibration which accompanies the voice in all parts of the chest. The hand applied to a healthy chest readily feels this general vibration; but a layer of liquid, interposed between the lung and the chest, acts as a damper, and prevents the transmission of the vibration.

The respiration is usually heard becoming *bronchial*, as the effusion increases up to a certain point; but then, as the bronchi themselves become pressed by further increase, it becomes faint, and at last ceases.

The *voice* furnishes a valuable sign. If it traverse a thin layer of liquid interposed between the lung and the ribs, it throws it into vibrations, and is itself modified, and rendered sharp and tremulous, resembling the bleating of a goat or lamb. This modification of the voice M. Laennec therefore called *ægophony*. Its most distinctive mark is its tremulous character. This is regarded as a pathognomonic sign of effusion into the pleura, as it can only be produced by this cause.

When the effusion is very considerable from the commencement, or becomes so during the progress of the disease, the ægophony disappears, and the respiration is no longer heard, unless where old adhesions retain some part of the lung near the ribs, and prevent it from being forced back by the effusion. The intercostal spaces become enlarged and elevated; the affected side is more expanded than the sound one, but is no longer influenced by respiration, its immobility forming a striking contrast with the great mobility of the other, in which the respiratory murmur is increased in intensity, so much so as to assume the "puerile" character. Now, as the sound of this respiration is sometimes heard on the diseased side, through the liquid, it will be necessary to guard against the error of mistaking it for a faint respiration on that side.

Another effect of a large collection of liquid in the chest is to displace the viscera in a remarkable manner. Thus an effusion on the left side will often displace the heart, and make it pulsate under, or even on the right of, the sternum. The liver will be pushed downwards by a large collection of fluid on the right side. These signs are important, because they distinguish this disease from hepatization of the lung, which is liable to be mistaken for pleuritic effusion, but which produces no such displacements.

The absorption of the fluid is indicated by the gradual return of the respiratory murmur: first, in those points where it had persisted in most cases the constitutional symptoms and local sufferings only are removed, while the effusion continues stationary, or perhaps even on the increase. It is at this period that, by small local bleedings, repeated counter-irritation, diuretics, and diaphoretics, we can generally succeed in effecting a cure.

In *chronic pleurisy* there is but little constitutional distress: yet the patient emaciates rapidly, the pulse is quick, and the breathing hurried. On examining the chest, one side is found dull and enlarged, the heart is displaced, and the respiration is puerile in the opposite lung.

In such cases, the patient must be confined to bed, his bowels be freely acted upon, and his diet consist of farinaceous substances. A few cups are to be occasionally applied to the affected side, and mild mercurials are to be exhibited, so as to induce slight ptyalism. Counter-irritants are now to be employed. M. Andral recommends, "that the blister to the chest should be replaced either by a seton, the suppuration of which should be kept up for a long time, or by a moxa." As all febrile symptoms subside, we may improve the patient's diet by allowing light broths, fresh eggs, &c.; diuretics should also now be had recourse to. In this stage, Dr. Stokes places great reliance on the internal and external use of iodine. When the absorption of the effused fluid has been effected, change of air should be recommended.

*Paracentesis.*—If effusion into the pleura is so extensive as to endanger the patient's life from the difficulty of breathing it occasions; or if his health and strength are giving way, it will be proper to make an aperture for the escape of the liquid by *paracentesis.*

## EMPHYSEMA OF THE LUNGS.

There are two varieties of this affection; one, in which the dilatation is confined to the air-vesicles; the other, in which the air has escaped from the air-cells into the surrounding cellular tissue, or beneath the surface of the pleura. The name of *vesicular emphysema* was given to the former by Laennec; the latter may be termed the *extra-vesicular.*

*Anatomical characters.*—In the *vesicular* variety the lung does not collapse in opening the chest; in consequence of the inelastic condition of the air-cells, the lung is very light and does not crepitate as much as in health; it feels firmer, and does not pit on pressure; its surface is irregular, from the projection of enlarged air-cells. The cells are enlarged, and sometimes several are fused into one, from the rupture of the intervening partitions. It may be confined to a single lobe, or to one lung, though most commonly it affects both lungs. In the *extra-vesicular* form the air which has escaped diffuses itself beneath the pleura in the form of little bladwhich may be pushed about. It may also get into the cellular between the lobes; or, if the rupture has occurred at the root lung, into the mediastinum; and thence into the cellular of the whole body. Sometimes the pleura gives way, admitne air into the cavity of the chest, and constituting *pneumo-* r.

*nptoms.*—Habitual dyspnœa, which, during the earlier periods disease, is mitigated in summer, but returns in the winte increased violence: the complexion is of a dusky hue; the nance has an anxious and melancholy expression; the nostrils lated and thickened; the lower lip is enlarged, and its mucous rane everted and livid. The movements of the thorax are lar and habitually unequal; inspiration is short, high, and ; but expiration is slow, incomplete, and, as it were, graduated; is thus a manifest difference in the duration of the two move- . The shoulders are elevated and brought forward, and the t stoops habitually, a habit contracted in his various fits of pnœa and cough; thus, even in bed, we find these patients g up, with their arms folded and resting on their knees, and the bent forwards, the object of which seems to be to relax the ab- al muscles, and to substitute the mechanical support of the for that of muscles which would interfere with inspiration. g the fits, the respiration becomes convulsive. There is a nt cough, returning in fits, usually dry, but often attended the expectoration of a viscid liquid, of a dirty gray colour. is one of the diseases long confounded under the name of *ma.*"

*ysical signs.*—The chest yields a morbidly clear sound on ssion; it is not, however, tympanitic, as in pneumo-thorax, but be described as the maximum of true pulmonary sound. This sive resonance is not given equally at all points, as the disease n extends to the whole lung. But although percussion indi- the presence of *air*, the ear applied to the chest detects that *ir is not in motion*, for there is very little or no vesicular ning. There is heard occasionally some *large crepitation*; this alled by Laennec *dry crepitation*, and he supposed it to be ced, like the crackling of a dry bladder, from the entrance of to the dilated vesicles. Dr. Watson, however, believes it to be g more than the crepitation of large bubbles of mucus, arising he catarrh, which is almost always present. Where this dis- s extensive, we generally find, owing to long-continued pul- y obstruction, that the right cavities of the heart are hyper- ed; this latter fact will obviously account for the congested larged state of the liver which also occurs.

extra-vesicular variety is apt to come on suddenly, from vio- spiratory efforts.

*Causes.*—Whatever produces violent or long-continued inspiratory efforts may result in a gradual and permanent dilatation of the air-cells. Thus dyspnœa, chronic bronchitis, spasmodic asthma, organic diseases of the heart, tubercles of the lungs, the presence of a tumour on the bronchial tubes, excessive exertions, diving and remaining long under the water, playing on wind instruments, &c.

*Treatment.*—This disease may exhibit itself under two circumstances: first, it may have existed from infancy, or the causes which produce it may have been present from the earliest period of life; second, it may result, as before stated, from obstructions dependent on bronchitis and the other causes enumerated. Now, in the first case, our treatment avails but little; all we can do is to palliate the symptoms: the mode of treatment in the second case is evident enough. In this disease we must, as in all others, direct our attention to the cause; in fact, we should as soon as possible remove the obstruction of the tubes, and then endeavour to restore the lung to its original condition. Bleeding or cupping may be requisite if bronchitis be present; or counter-irritation by blisters, sinapisms, &c.

The patient should clothe warmly, particularly about the feet, and should live in a sheltered genial situation. He should also take care to avoid all causes of indigestion and flatulency, because, if the action of the diaphragm is impeded, an attack of dyspnœa may be brought on directly. He should, if possible, reside in an equable climate.

The fits of dyspnœa may often be relived by opium, ether, or Hoffman's anodyne; or if of a more spasmodic character, by a mixture of syrup of seneka, squill, and tincture of lobelia.

## PHTHISIS PULMONALIS.

Phthisis pulmonalis, or *pulmonary consumption*, consists in the development in the lungs of a substance called *tubercle*. The peculiar constitution which gives a tendency to the disease is named the *tuberculous diathesis*.

*Of tubercle.*—Andral describes tubercle, at its origin, as a pale yellow, opaque, round body, of various degrees of consistence, in which no trace of organization or texture can be detected by the naked eye, although the microscope shows various forms of cells, imperfectly developed; so that tubercle evidently consists of unhealthy lymph, whose powers of organization are imperfect.

*Seat of tuberculous matter.*—The prevailing opinion among pathologists is, that the seat of tuberculous matter is the cellular tissue of organs. It may, however, be formed on secreting surfaces; as, in the mucous follicles of the intestines, on the surface of the pleura and peritoneum, and likewise in false membranes, or other morbid products, and in the blood itself.

Dr. Carswell regards the mucous surfaces as the principal seat of tuberculous matter; and asserts, "that in whatever organ the formation of tuberculous matter takes place, the mucous system if constituting a part of that organ, is in general either the exclusive seat of this morbid product, or is far more extensively affected with it than any of the other systems or tissues of the same organ." Andral considers the cellular tissue its chief seat, but that it may occasionally occur on mucous and serous surfaces. Lombard supposes it to be restricted to the cellular tissue.

In confirmation of Dr. Carswell's statement, he has shown it in the lungs formed on the secreting surface, and collected within the air-cells and bronchi; in the intestines, in the isolated and aggregated follicles; in the liver, in the biliary ducts and their extremities; in the kidneys, in the infundibula, pelvis, and ureters; in the uterus, in the cavity of that organ and Fallopian tubes; and in the testicle, in the tubuli seminiferi, epididymis, and vas deferens. The formation and subsequent diffusion of tuberculous matter is also observed on the secreting surface of serous membranes, particularly the pleura and peritoneum; and in the numerous minute cavities of the cellular tissue. The accumulation in the lacteals and lymphatics, both before and after they unite to form their respective glands, is frequently very considerable.

*Morbid appearances and Pathology.*—Tubercles in the lungs in their earliest stage, may present themselves in three forms: 1st. The *common cheesy tubercle*, in yellowish friable masses, in more or less rounded masses, or sometimes filling one or more of the bronchial tubes. 2d. *Miliary tubercles;* small granules, like millet seed, bluish white and semi-transparent, often found in great quantities. Some pathologists consider these as the earliest stage of the yellow cheesy tubercle; others, on the contrary, believe them to be merely some of the air-vesicles solidified by chronic inflammation. But certain it is that they have some relation to the regular tubercle, as they are found in the same person and in the same parts of the lung. 3d. *Tubercular infiltration;* the morbid matter being diffused uniformly through a tissue, and not agglomerated in masses.

Tubercle when deposited may lie dormant for a long time, without exciting any particular symptoms. In very rare and favourable cases, their softer particles may be absorbed; and nothing be left but the phosphate and carbonate of lime they contained, which may lie quietly in the lung for a whole life. But, in general, tubercle, after a time, acts as a foreign body, excites inflammation and suppuration in the neighbouring sound parts, and is expelled.

The first visible step is a *softening*, which usually commences in the centre, and gradually advances till the whole is reduced to a soft yellowish mass resembling pus. This increases, till an abscess forms, called a *vomica*.

The vomica enlarges till it bursts into a neighbouring bronchial tube; and then, in *favourable cases*, after the expulsion of the tubercular matter and pus by expectoration, the cavity may contract, become smooth and cartilaginous on its inner surface, and at last be obliterated, and the phthisis be cured.

More generally, however, fresh tubercle is deposited, fresh vomicæ form, and unite, till the patient's lung is riddled with cavities, and he dies exhausted. One or more bronchial tubes are found opening into each vomica.

Tubercle generally occasions some degree of pleurisy and consequent adhesion; this diminishes the frequency of what, nevertheless, happens sometimes, viz., ulceration of the pleura, and escape of the matter from a vomica, and, of course, of air into the pleural cavity; constituting a kind of *pneumo-thorax*, sometimes met with in the last stages of phthisis.

Ulceration of the larynx, tubercular deposits in, and ulceration of the intestinal glands, and a peculiar fatty condition of the liver, are morbid appearances often met with in the phthisical.

Tubercles most frequently are found in the *upper* lobes, and generally at first in the *left* lung.

*Symptoms.*—It usually commences with a dry, hacking cough, which afterwards becomes mucous. The sputa are at first clear, then opaque, and of a peculiar character, to be noticed presently. The pulse becomes somewhat accelerated, fugitive pains are felt about the chest or in the scapular region, emaciation begins to come on, though the appetite may continue unimpaired. The *emaciation* is the symptom which should especially demand attention. Months may pass by without any particular change in the patient's condition from what has been just described; and usually no apprehension is entertained.

Frequently the first thing that occasions alarm is a hemorrhage from the lungs; or, it may be an attack of pleurisy, which proves very obstinate. This constitutes the *first* stage of the disease. The fever now begins to be somewhat paroxysmal, and is attended with some perspiration at night. These symptoms mark the *softening* of the tubercles. Sometimes the first apparent symptoms are those of bronchitis; and this, as well as the pleurisy already mentioned, may prove both the effect and exciting cause of phthisis.

In the *second* stage, the expectoration changes; instead of the mucous or muco-purulent character previously presented, and which was due to the attendant bronchitis, it now, although still purulent, exhibits lumps of a cheesy matter, whence it is named *nummular*. This indicates the discharge of the softened tubercle. If the cavity be very large, this sign subsequently ceases, and the expectoration becomes more uniform. Now there is an increase of the fever, which becomes decidedly *hectic*, and which is produced by the constant irritation in a debilitated system. There is no regularity in the chills. Profuse sweats occur at night, during sleep, owing also to debility, and contributing farther to weaken the patient. Occasionally, at this stage, there is hemoptysis, arising from the opening of some small vessel by ulceration; this symptom tends to confirm the diagnosis. There may also be occasional attacks of slight intercurrent pleurisy, indicated by sharp pain in the side. The finger-nails become curved and in women the catamenia are suppressed. The symptoms are often ameliorated just at this point, because the softened mass—the source of irritation—has been entirely removed; but in the mean time others are going on to soften. The digestive system now begins to suffer; thirst, loss of appetite, and abdominal pains, torment the patient, and the first indications of the wasting and persistent diarrhœa appear; the patient feels he can lie better on one side than the other, and begins to feel pain in the opposite side of the chest,—a sure sign that his terrible disease has invaded the remaining lung.

In the more advanced, or *third stage*, the debility and emaciation very much increase, the patient is confined to bed, œdema of the feet and legs appear, aphthæ occur in the mouth, and desquamation of the epithelium from the throat, occasioning the sore-throat so often complained of; bed-sores are apt to be formed; the dyspnœa at times is excessive, though generally it is much less than might be expected from the amount of lung involved. If the digestive organs are not implicated, the patient continues cheerful and hopeful to the very end. Death may occur suddenly from hemorrhage from the lungs, or from a sudden congestion of the sound portions; or from pneumothorax, or from ulceration of the bowels bringing on peritonitis; or the closing scene may be very gradual and dependent only on the debility.

*Hæmoptysis* has been often regarded as a *certain* sign of phthisis. But this is an error, since pulmonary hemorrhage may undoubtedly occur as an independent affection, especially in women. In the latter, pregnancy almost always arrests the progress of the disease; but after delivery, it recommences with increased vigour. The explanation of this is that there is an increase in nutrition owing to the presence of the fœtus in utero.

Bronchitis is a necessary accompaniment of phthisis; likewise pneumonia, pleurisy, meningitis, and peritonitis frequently coexist with it.

*Physical signs.*—It will be remembered that in the condition of the lung in the early stage of the disease there is a deposit of tuberculous matter, usually at the summit. This, of course, must give greater solidity to that portion, and consequently, dulness on percussion, together with great feebleness, if not entire absence, of vesicular respiration. Bronchial respiration will also be heard if a large bronchial tube be enclosed in the solidified portion, and a prolonged sound of *expiration*. Again, as more or less bronchitis necessarily results from the presence of tubercles, we shall have likewise the physical signs of that disease, as the moist and dry rhonchi. Inspection of the chest often exhibits a marked depression under the clavicle of the affected side, arising either from the shrinking of the lung from consolidation, or from intercurrent pleurisy.

The sounds of the voice and heart are conveyed with greater loudness through the solidified structure; hence *bronchophony* is frequently heard.

As the period of softening approaches, the indications of air passing through a fluid, or passing in and out of a cavity, are afforded. First, supposing the vomica to be half filled with liquid, and to communicate freely with the air-tubes, there will naturally be heard on every entrance and exit of air, a *gurgling* sound, like the bursting of very large bubbles. The same may also arise from dilatation of the bronchi, or from abscess of the lung; but these conditions, and especially the last, are rare.

If the vomica is empty, there will be heard a class of sounds called *cavernous respirations;* consisting of certain variable sounds indicating the passing of air into and out of a cavity.

If the vomica be partially full of liquid, the latter may perhaps be heard to splash, when the patient coughs.

The particular resonance of the voice which constitutes *pectoriloquy*, is another sign of a vomica. When a cavity of moderate size and regular form, empty, or nearly so, is in free communication with a large bronchial tube, and is very near the surface of the lung in contact with the thoracic parietes, or when the intervening structure is rendered a good conductor by condensation, the voice is transmitted in the most perfect and unmodified manner, and seems to be produced in that spot of the chest, seemingly distinct from the oral voice. This is *perfect pectoriloquy*. If heard with the stethoscope, the sound of the voice seems to come through the tube, and enters the observer's ear louder than that which, coming from the patient's mouth, strikes the other ear; but the utterance is never so distinct. When heard to this degree in parts where there is naturally little or no resonance of the voice, it proves beyond doubt the existence of a cavity communicating with the bronchi.

By *imperfect pectoriloquy* is meant that form in which the voice does not seem to enter the stethoscope, but only to resound at the end. This sign cannot be relied upon when heard in the sternal half of the infraclavian and mammary regions, the axillæ, and interscapular spaces.

There is yet another class of sounds to be spoken of. It was said before, that the pleura sometimes ulcerates, so that a communication is formed between a vomica and the pleural cavity. In consequence of this aperture, air passes at each inspiration into the pleural cavity whilst the lung collapses; and more or less liquid will also escape from the vomicæ. The spot where this perforation occurs, is generally, says Dr. Watson, opposite to the angle of the third or fourth rib. The indications of this state of things will be, 1st, great clearness on percussion; 2d, complete absence of respiratory murmur; 3d, a peculiar resonance of the voice, breathing, and cough, called by the French *amphoric resonance.* This is a sound of metallic character, and greatly resembles that produced by speaking or coughing over an empty barrel or copper boiler, or by blowing into an empty bottle; 4thly, there is occasionally a tinkling sound of a metallic character, produced by the fall of a drop of liquid from the upper to the lower part of the cavity.

Now, these four sounds, all indicating, as they do, the existence of a large cavity containing air and liquid, and communicating with the trachea, are generally caused by pneumo-thorax, as before said. But they may also, though very rarely, be caused by the presence of a very large vomica. In this case they will only be heard in the upper part of the chest, and instead of great clearness, there will be extreme dulness on percussion.

Another mode of physical exploration is by the use of the *spirometer*, by means of which the *vital capacity* of the chest is ascertained.

*Of the sputum.*—In pulmonary consumption, there is no constant relation between the appearances of the expectorated matter and the state of the lung. In many cases, it is not at all characteristic; indeed, it may be mucous while large cavities exist in the lung, or purulent from bronchial irritation. Dr. Forbes observes—"In the earliest stage of the disease, the cough is either quite dry, or attended by a mere watery or slightly viscid, frothy, and colourless fluid: this, on the approach of the second stage, gradually changes into an opaque, greenish, thicker fluid, intermixed with small lines or fine streaks, of a yellow colour. At this period, also, the sputa are intermixed with small specks of a dead white or slightly yellow colour, varying from the size of a pin's head to that of a grain of rice, and which have been compared by Bayle to this grain when boiled. These have been noticed by many writers, from Hippocrates downwards. After the complete evacuation of the tubercles, the expectoration puts on various forms of purulency, but frequently assumes one particular character, which has always appeared pathognomonic of phthisis, although the more accurate and extensive observation of modern pathologists has proved the same to exist occasionally in simple catarrh. The expectoration alluded to, consists of a series of globular masses, of a whitish-yellow colour, with a rugged woolly surface, and somewhat like little rolled balls of cotton or wool. These commonly, but not always, sink in water. This kind of expectoration has appeared most common in young subjects, of a strongly-marked strumous habit, and in whom the disease was hereditary. At other times, in the cases in which these globular masses are observed, and also in those in which they have not appeared, the expectoration puts on the common characters of the pus of an abscess, constituting a uniform, smooth, coherent, or diffluent mass, of a greenish, or rather grayish hue, with an occasional tinge of red (from intermixed blood), and sometimes more or less fœtid." Dr. Stokes considers the expectoration, in which the globular ragged masses here described are expelled, more peculiarly allied to phthisis than any other. He also adds, "I do not recollect a single case in which I observed this character, that did not turn out to be phthisis."

*Course.*—The ordinary course of phthisis is slow, from one to two years; it may even be much more protracted. But sometimes it is very rapid, terminating in six or eight weeks. Such cases are termed *acute phthisis*, or *galloping consumption;* they usually depend upon an excessive deposit of *miliary* tubercles throughout the lungs.

*Prognosis and Treatment.*—Phthisis unfortunately generally proves fatal, though by no means universally so; proofs of its occasional curability are afforded in the cicatrices found in the lungs, in persons who have afterwards died of other diseases. The chances of cure depend upon the quantity of the tubercle deposited, and upon the tendency in the constitution to deposit more. No *medicine* can cause its removal, but the system can be supported until nature accomplishes this; and the tendency to farther deposition may often be obviated. Hence, the main point in the treatment is *a proper hygiene.* The process of nutrition should be invigorated up to the healthy standard, but not beyond this. The food should therefore be nutritious, and easy of digestion; stimulation should, as a general rule, be avoided, although in some cases the moderate use of wine, or the malt liquors, may be allowed. *Exercise* is specially important. This should be taken as much as possible in the open air, on foot, or still better on horseback. It should be steady and habitual, and the patient should not be kept within doors, even in cloudy weather, provided only he is warmly clothed. This last is a point of great importance, and is too commonly neglected. A residence in a warm, dry climate, especially during the winter season, is always desirable; and the inhalation of the air from a pine forest is by some deemed beneficial.

The medicinal agents are—tonics, if the digestion is enfeebled, particularly the cold infusion of wild cherry bark; iron and iodine, if there is anemia; but the most important of all is cod-liver oil.

(diastole) of the ventricles. This second sound is said to be produced by the shock caused by the tightening of the semilunar valves at the ventricular diastole. Laennec rates the relative duration of these sounds to be as follows—The first sound, two-fourths; the second sound, one-fourth, or a little more; the interval of silence, one-fourth, or a little less. These sounds are naturally most distinct in the space between the cartilages of the fourth and seventh ribs of the left side, and on the lower part of the sternum; the former part corresponding with the left, and the latter with the right side of the heart. Simultaneously with the first, or systolic sound, an impulse or shock is communicated to the stethoscope. It is most perceptible at and between the cartilages of the fifth and sixth ribs, where it may be felt by the hand; but the stethoscope commonly renders it sensible in lean persons over the whole præcordia. Considerable variety in the force of the impulse may occur from various extraneous causes acting on a healthy heart. Thus, the pressure of tumours behind it, flatulent distension of the stomach, great enlargement of the liver and spleen, contraction of the chest from pleurisy, deformity of the spine, and similar causes, which have the effect of pushing the heart into closer contact with the anterior walls of the chest, will make its impulse against them stronger. Again, extensive effusions of air or liquid in the left pleura may displace the heart, so that its impulse can only be felt under or even to the right of the sternum. The action of the heart is naturally accelerated by exercise, stimulating drinks, heat, &c.; and this excited action is attended with an increased impulse and with louder sounds.

*Exact position of the heart.*—"A line," says Dr. Hope, "drawn from the inferior margins of the third ribs, across the sternum, passes over the pulmonic valves a little to the left of the mesial line, and those of the aorta are behind them, but almost half an inch lower down. A vertical line coinciding with the left margin of the sternum has about one-third of the heart, consisting of the upper portion of the right ventricle on the right, and two-thirds, composed of the lower portion of the right ventricle, and the whole of the left, on the left. The apex beats between the cartilages of the fifth and sixth left ribs, at a point about two inches below the nipple, and an inch on its sternal side."

"Take the fifth costal cartilage on the left side," says Dr. Latham, "and let a point midway between its junction with the sternum and its junction with the rib be the centre of a circle, two inches in diameter. This circle will, as nearly as possible, define the space of the præcordial region, which is naturally less resonant than the rest."

*Relation of the sounds to the state of the heart.*—"A clearer sound," says Dr. Latham, "proceeds from a thin heart; and a duller sound from a thick heart; a sound of greater extent from a

Endocardial murmurs (i. e., murmurs *within* the heart) are caused by peculiar *vibrations of the columns of blood* which pass through the heart; and these vibrations may depend,—1st, upon an unnaturally thin *quality,* and deficient quantity *of the blood,* as in the murmurs heard after hemorrhage; 2dly, *on disease of the valvular orifices* of the heart, offering obstacles to the passage of the blood.

A murmur caused by the passage of the blood through a diseased valvular orifice may be *direct* or *regurgitant;* that is, may be produced during the flow of the blood along its natural channel, if contracted; or during its regurgitation, which will happen if the diseased valve is unable to shut properly.

In order to ascertain what valve is diseased, notice must be taken of the *time* at which the murmur is heard;—of the *part* of the præcordial space *where it is heard most loudly;* and of the *direction in which it is conveyed the farthest.*

Valvular disease of the right side of the heart is very rare indeed; and the diagnosis of it from disease on the left side is a matter of some uncertainty. The following observations, therefore, chiefly apply to the aortic and mitral valves.

When a single endocardial murmur is heard during the *systole* of the heart, its seat is most probably the aortic valve, which is thickened so as to impede the blood in its exit from the heart and to throw it into vibration.

When a single murmur is heard, coincident with the heart's *diastole,* this also may be produced by a diseased aortic valve, if so diseased as to be incapable of closing, and permit the blood to *regurgitate* into the ventricle.

When there is a double murmur, both *systolic* and *diastolic;* these also may arise from disease of the aortic orifice alone; the former being a murmur caused by the flow of blood from the heart; the latter by its regurgitation.

Again, when there is a *single systolic murmur,* it may be caused by disease of the *mitral valve,* permitting the blood to regurgitate into the left auricle from the ventricle, when the latter contracts.

The spot where all endocardial murmurs are heard most distinctly, is immediately over the valve which originates them. And the space under which the cardiac valves lie, may be said to be comprised *between the lower margin of the 3d left costal cartilage, and the lower margin of the 4th;* extending inwards to the middle of the sternum. Here it is that almost all murmurs are heard most clearly.

The method of distinguishing them from each other is based on the fact that the murmur will be conveyed along the direction of the column of fluid whose vibration causes it.

Thus if a murmur be seated at the aortic valve, it will be heard most clearly *over the left half of the sternum, between the 3d and 4th costal cartilages.* But the sound will also be conveyed with tolerable clearness *in the course of the aorta and its branches;* that is to say, upwards and between the second and third ribs of the *right side*—perhaps it will also be heard in the carotids.

If the disease (which is very rare) were seated in the *pulmonic valves,* the murmur would follow the course of the *pulmonary artery,* upwards between the 2d and 3d ribs of the left side.

If it were seated in the *mitral valve,* the murmur would be lost if the stethoscope were moved upwards; but would still be heard distinctly if it were moved *downwards towards the apex of the heart.*

If the murmur is heard plainly in *both directions,* then *both aortic and mitral valves* are probably diseased.

There are some few circumstances which must be taken into account in estimating the value of endocardial murmurs as signs of valvular disease.

For first, they are sometimes absent altogether when the patient is in repose; although they may be excited by causing the patient to move about, so that the heart may beat more forcibly.

Secondly, the loudness of the sound is by no means a measure of the extent of the disease; for in long-standing cases, where a diseased orifice has become very contracted, the sound often becomes very feeble indeed.

Thirdly, very violent action of the heart alone, without valvular disease, may occasion a murmur; this often happens to children; seldom to adults.

Fourthly, if the heart is embarrassed by deformity of the chest, or if it is too much pressed upon by the stethoscope, murmurs may be created.

Fifthly, in cases of anæmia, after hemorrhages, or when the blood has become pale and watery through ill health, there will be a loud systolic murmur, conveyed along all the arteries; and also often accompanied by a continuous humming noise heard in the veins, especially the internal jugular. This state is to be remedied by nourishing food and tonics.

Lastly, the sounds of respiration may imitate cardiac murmurs so closely, that it may be necessary to make the patient hold his breath, to distinguish their real source.

## INFLAMMATION OF THE HEART; ENDOCARDITIS, AND PERICARDITIS.

These maladies are generally found to be concomitants of *rheumatism.* No doubt they do often occur from other causes; and they often occur, too, in slight degrees without being complained of or suspected.

*Symptoms.*—The symptoms of endocarditis are, 1st, *pain* in the heart; 2d, *disordered action* of the heart, which may be violent, or else feeble, irregular, and intermitting; 3dly, some dyspnœa; and, lastly, *abnormal sounds;* beginning with a *roughness* and afterwards, a murmur, termed the *bellows murmur,* arising from thickening of, or deposit on some of the valves. One or more of these symptoms, occurring in the course of acute rheumatism, may be considered a sign of endocarditis.

The pain is sometimes so slight that the patient scarcely notices it, if at all; but in dangerous cases is an extreme anguish, liable to be followed by orthopnœa, restlessness, delirium, and death. The murmur sometimes is heard at the very beginning, whilst there is no other symptom or complaint about the heart; sometimes it does not come on till the middle or end of the disease.

The symptoms of *pericarditis* are, 1st, pain in the region of the heart, augmented by pressure and by a deep inspiration; 2dly, irregular or violent action of the heart; 3dly, difficulty of breathing; and, lastly, the *physical signs*—an *exocardial murmur,* caused by the rubbing of the roughened and inflamed serous surfaces of the heart and pericardium against each other; dulness of percussion over an unusually large space of the præcordial region; and sometimes a distinct undulation visible between the cartilages of the 2d, 3d, and 4th left ribs. The exocardial murmur resembles the rubbing of two rough surfaces against each other—it is called by Dr. Watson the *to and fro sound;* which name well expresses its character. The dulness on percussion, and the undulation, arise from the presence of fluid effusion in the pericardium.

The friction sound ceases of course if the heart and pericardium become adherent together.

Inflammation of the heart is sometimes attended with so much nervous and cerebral irritation, as to mislead the practitioner, unless very cautious, and induce him to look at the head instead of the præcordia.

Pericarditis, like endocarditis, may come on in the course of acute rheumatism, without being denoted by pain, or any symptom sensible to the patient. The region of the heart should therefore be frequently scrutinized by the stethoscope in rheumatism, and proper measures be adopted as soon as there is the first indication of murmur.

*Frequency of the disease.*—Dr. Latham shows that the heart is much more frequently inflamed in acute rheumatism than is often imagined. Out of 136 cases of that disease, the heart was inflamed in 90, about two-thirds; of these 90 cases there were 63 of endocarditis; 7 of pericarditis; 11 of endocarditis and pericarditis combined, and 9 in which the seat was doubtful.

Out of this number there were but three deaths; but yet in the gurgitation of the blood, producing an accumulation behind. Suppose the left auriculo-ventricular (mitral) valve to be affected: if its orifice is contracted, the blood, being impeded in its course, accumulates in the left auricle, and distends it; congestion of the pulmonary veins is the consequence; the lungs share in this congestion, and pulmonary apoplexy may be the result. This must, of course, occasion an insufficient supply of blood to the general system, to relieve which, the heart must make greater efforts; and thus hypertrophy may follow. Again, suppose some insufficiency in the mitral valve, owing to ulceration, for example, the blood will regurgitate into the left auricle at each pulsation, producing, as before, congestion of the auricle and lungs, and hypertrophy of the heart.

In contraction of the *semilunar valves of the aorta*, a less supply of blood is sent to the general system, but congestion and consequent hypertrophy, and also dilatation of the left ventricle may occur. If these valves be imperfect through ulceration or adhesion, the regurgitation into the ventricle produces hypertrophy and dilatation, will a full, *jerking* pulse.

*General symptoms.*—Dyspnœa, increased by muscular efforts, or emotion; palpitations, also increased by the same causes; the pulse often intermittent, jerking; at other times, very frequent, small, and irregular.

*Physical signs.*—The pathological sounds are termed *murmurs*. It is very important to distinguish between the murmurs of functional and organic disease. In *mitral contraction*, the murmur must accompany the second sound, because occurring during the diastole of the ventricle, and the passage of the blood from the auricle into the ventricle. It is heard over the ventricles, between the fourth and fifth ribs,—rather than *immediately* over the valves, because the lung here interferes. It is never heard *above* this point,—which will distinguish it from aortic valvular deficiency. Another point to be remembered is, that the second sound of the heart is also distinctly heard, showing that the aortic valves are sound.

In *mitral deficiency*, the abnormal sound will accompany the ventricular contraction, and will hence be heard accompanying the *first* sound. It is a loud and prolonged murmur in a low key, like whispering the word "who;" it is the most common of the abnormal sounds, and is heard over the seat of greatest dulness.

In *contraction of the aortic valves*, the murmur accompanies the first sound, and is heard over the third rib, and upwards and to the right of the sternum, in the course of the aortic arch. It is comparatively superficial, and sounds like whispering the letter "z."

In *aortic regurgitation*, the murmur accompanies the second sound, and is heard near the apex of the heart, because produced by the blood rushing down into the left ventricle, through contraction of the aorta. It is superficial, and not very strong, and is likewise heard high up in the course of the aortic arch. In slight aortic regurgitation there is only a blurred second sound.

In valvular disease of the *right* side, the sounds are much the same as those of the left side. The *tricuspid* murmurs are heard at the right of the sternum; those of the *pulmonary semilunar valves* are superficial, and on the *left* of the sternum.

*Treatment.*—If taken early, it may be cured. If it is the result of inflammation, the proper plan would be a long-continued but moderate use of mercury, so as not to affect the gums. Iodine may also be cautiously employed, either alone, or in conjunction with mercury. If it can be traced to a rheumatic or gouty diathesis, a protracted use of the alkalies, with colchicum, is indicated. Counter-irritation by means of cups repeated, or blisters, or pustulation, will also be serviceable.

### HYPERTROPHY AND DILATATION.

The dimensions of the heart may be increased, either by augmentation of its muscular walls, or enlargement of its cavities. The name *hypertrophy* is given to the former of these conditions, when resulting from an increase of its muscular substance; that of *dilatation* to the latter. Both conditions are apt to coexist.

The average size of the healthy heart is usually described as about that of the individual's fist; the thickness of the left ventricle, four to six lines; that of the right, two to three lines; that of the left auricle, about one and a half lines; that of the right auricle, about one line. The *cavities* are very nearly of equal size, and are capable of containing, each, about two fluid ounces.

Sometimes all the cavities are enlarged, changing both its shape and position. Again, only one cavity may be hypertrophied, in which case the other will resemble a small appendix. The columnæ carneæ are also generally enlarged at the same time. It is rare to witness dilatation of all the cavities; the ventricles are more liable to it than the auricles.

Several varieties of hypertrophy are usually described, viz.,—*simple hypertrophy*, in which the muscular parietes are thickened, but the cavities unaltered in size; *hypertrophy, with dilatation*, or *eccentric hypertrophy*, in which there is also an increase of the capacity of the cavities; and *concentric hypertrophy*, in which the substance of the heart is thickened, and its cavities diminished.

Modern pathologists have decided that the *concentric hypertrophy* is a pathological mistake; that, in fact, it depends on the state of contraction in which the heart happens to be left at the moment of death; and that the so-called concentric hypertrophy often vanishes as the *rigor mortis* goes off, and the heart dilates and becomes flabby.

*General symptoms.*—One of the most prominent is dyspnœa, produced by any exertion; also, palpitations, which are sometimes so violent as to shake the whole body; præcordial uneasiness. The *secondary* signs are, violent headache, vertigo, buzzing in the ears, flashes of light, pulmonary congestion, pneumonia, apoplexy of the lungs, congestion of the liver, bilious disorders, and dyspepsia, and finally, general and local dropsy. Towards the close, the patient's suffering is extreme; unable to lie in bed, he is forced to assume constantly a sitting posture, with the body bent forward. Death sometimes occurs very suddenly in syncope.

*Hypertrophy of the left ventricle* may be caused, *first*, by circumstances that excite the action of the organ to a great degree; such as high living, violent exercise, and mental excitement; and, *secondly*, by obstructions of the mouth of the aorta. These, of course, require greater muscular force to be exerted in order that the blood may be propelled in the same time through a small aperture as through one of the natural size.

*Hypertrophy with dilatation* is much more common under the last-mentioned circumstances, than simple hypertrophy; for the same cause that obstructs the current of blood, will also give the cavity a tendency to dilate, especially if the patient has but little tone and vigour in the muscular system.

The symptoms are, a very strong and full pulse, all the functions are for a time invigorated, flushed face, prominent eyes, headache, tendency to apoplexy. If there be, at the same time, mitral regurgitation, the pulse will be softer, and there will be the valvular murmur.

*Hypertrophy of the right ventricle* is not accompanied by a similar pulse. It is generally attended with tricuspid regurgitation, which produces a pulsation in the jugular veins.

The impulse is stronger and more extensive; the first sound is duller than usual. Percussion is duller; and often there is greater prominence in the præcordial region.

*Dilatation without hypertrophy.*—This is a kind of muscular atrophy, and happens to flabby cachectic patients, in whom the heart gives way and stretches in efforts to carry on the circulation.

The signs of dilatation are such as arise from a want of duly aerated blood in the different parts of the body; such as pale face, purplish lips, feeble pulse, general paleness of the surface, œdema of the feet, the movements of the heart feeble and prolonged, great disposition to faintness, and tendency to passive hemorrhage and dyspnœa on the slightest excitement.

The *sounds* are clearer than natural, accompanied by dulness on percussion, and a feeble pulsation.

*Causes.*—Valvular disease is the most frequent cause; rheumatic irritation, any cause producing constant and excessive exertion of the organ, as violent exercise, playing on wind-instruments, violent s, intemperance in eating and drinking, emphysema of the sthma; anemia predisposes to it by occasioning relaxation. *tment.*—It is curable if the valves are not implicated, and n in the early stage. The great point is to remove the g cause, especially valvular disease. Regulate the patient's f life and occupation; moderate his diet; occasional *moderate* gs in hypertrophy; with an active pulse, or cupping, if there ; but avoid large bleedings; occasional saline cathartics; exercise. *Digitalis* is the special medicine; prussic acid is ed for the same purpose; tincture of aconite and colchicum, it has resulted from rheumatism; constant revulsion to the

*ilatation*, the object is to produce good blood; hence bleeding be avoided; tonics, iron, cod-liver oil, and animal food should ected, with an occasional small dose of a saline cathartic. lis is here specially required. The wild-cherry bark is an nt tonic; and as nervous symptoms are very apt to be present ales, opium, belladonna, valerian, &c., may be given with ad- e.

ious other organic diseases of the heart are occasionally wit- , but as they are comparatively rare, and for the most part le, it will suffice barely to mention them here.

*phy* occasionally occurs. *Softening* may take place without nation; it may result in a rupture of the heart. Various *tions* of the heart may occur, as of the *fibrous*, *cartilaginous*, *eous* character. *Fatty degeneration* is a rare disease. *Tu- carcinoma*, and *polypi* are also rarely noticed.

## ANGINA PECTORIS.

dreadful complaint attacks persons who have some organic ion of the heart, and generally of an atrophic character. In ases the heart has been found excessively loaded with fat; rs there has been a softness of the heart; in others disease valves or of the aorta; and in several *ossification of the co- artery*, a change which would, of course, greatly interfere e proper nourishment of the heart.

*ptoms.*—These seem to be of the nature of a *cramp*, or *spasm eart*, combined with inability to propel its contents properly. tient, in walking briskly, especially if he does so after a s seized with a peculiar pain in the region of the heart. It n of an alarming nature to the patient, who often feels that t stop and support himself, and as if another step would be The pain goes through to the back, and often shoots down elbow of the left arm. The pulse sometimes stops during oxysm. When it has lasted some seconds, it goes off.

The attacks, generally, as the disease advances, become more and more frequent and violent, and more easily induced.

*Treatment.*—This may be comprised in the word *quiet*. The patient should be warned of his danger; and the means which have been before spoken of should be employed to allay irritation of the diseased organ, taking care neither to weaken the patient too much on the one hand, nor on the other to let his veins become too full, or the liver and kidneys inactive.

### FUNCTIONAL DISEASES OF THE HEART.

These are exhibited under two main forms,—*palpitations* and *neuralgic pains*.

The symptoms often strongly resemble those of organic disease, such as dyspnœa, pain, &c.; but the characteristic distinction is *the want of a constant murmur* in merely functional disorder.

The *causes* are such as produce general nervous derangement, as the excessive use of tobacco, or of coffee and tea, dyspepsia, flatulence, hysteria, severe study, depressing emotions, sexual excesses, and anemia. They are most apt to occur about puberty, or a little after; and in females more than in males.

The *treatment* is to be conducted on general principles,—removing all known causes, and employing of tonics, chalybeates, antispasmodics, and exercise.

## DISEASES OF THE BLOOD-VESSELS.

### ARTERITIS.

Inflammation of the arteries is rare in the acute form. The symptoms are pain and tenderness along the course of the vessel, attended with a thrill or throbbing. Coagulable lymph is effused within the vessel, often producing a complete arrest of the circulation, and resulting in gangrene. It is highly probable that many cases of spontaneous gangrene in old people are thus produced.

*Chronic arteritis* is probably more common; but is not usually discoverable before death. Atheromatous deposits may occur in the coats of the arteries, exciting ulceration. They are also liable to *ossification* as age advances.

The *treatment* consists in bleeding, leeching to the part affected, blisters, and fomentations.

### PHLEBITIS.

Inflammation of the veins is of frequent occurrence. The signs are pain and tenderness in the course of the vessel, which soon becomes cord-like and knotted, by which it may be distinguished from arteritis. There are swelling and redness of the adjacent

### PURPURA.

This consists in the production of livid or purplish spots, generally commencing at the lower extremities. Two varieties are described—*purpura simplex* and *p. hemorrhagica*, although it is probable they do not essentially differ; in the latter, there is also effusion of blood into the mucous membranes.

Sometimes there are constitutional symptoms, as in scurvy, especially neuralgic pains in the back. It appears often in successive crops; the spots being usually small, but at times becoming very large, by increase of the effusion. Occasionally it is periodical. It is not elevated, nor is it accompanied by any sensations. It is simply an effusion of the colouring-matter of the blood.

In p. hemorrhagica the blood escapes from the gums, lungs, &c.

*Causes.*—Not well understood. It occurs in depraved constitutions, as a general rule, though this is not always the case; it is more common in the young, and in the very old. It most resembles scurvy, in its general character, though it differs from it in not being prevented nor cured by fresh vegetable food. In purpura, the gums, although purplish, do not soften, nor swell, nor ulcerate, as in scurvy.

*Treatment.*—The main indication is to correct the low state of the blood, by a milk diet and tonics; astringents for the hemorrhage; also opium.

## HEMORRHAGES.

### EPISTAXIS—BLEEDING FROM THE NOSE.

There is no part of the body more disposed to hemorrhage than the pituitary membrane, and none in which the recurrence of the discharge is productive of so little injury, as respects either the structure or the constitution. The blood effused from this membrane may be discharged either by the nostrils or by the mouth, after having passed into the posterior fauces.

*Causes.*—In its idiopathic states, epistaxis occurs most frequently in children and young persons. In the more mature periods of life, it is most frequently symptomatic, or dependent upon disease of the heart, of the liver, spleen, or of some other viscus, or consequent upon the disappearance of some sanguineous or other evacuation. The *external* causes are, injuries, irritants, exposure of the face to fires or to the sun's rays. The *internal* causes are, whatever increases the flow of blood to the head, as mental excitement, sneezing, catarrh, &c., &c.

*Symptoms.*—The sthenic form is ushered in by pain of the head, vertigo, or somnolency; with increased pulsation in the temporal arteries. The sthenic epistaxis is often symptomatic or *critical* of membrane of the bronchi; *secondly*, from a vessel ulcerated in a tuberculous excavation; *thirdly*, from an aneurism of the aorta, or of the large trunks arising from its transverse arch, it which case it will be soon fatal.

*Pathology.*—Some few cases of hæmoptysis depend on suppression of the menses, and are habitual and not dangerous; but in by far the majority of cases it depends on disease of the heart, or on the irritation of tubercle. Hypertrophy of the right ventricle is generally supposed to be a frequent cause of pulmonary hemorrhage; but the momentum caused by hypertrophy of the right ventricle is rarely sufficient to rupture any branch of the pulmonary artery. Dr. Watson states, "that every instance of pulmonary hemorrhage dependent upon organic disease of the heart, which he had observed, coincided with disease on the left side of that organ, mechanically obstructing the return of blood from the lungs. The obstacle has sometimes been placed at the entrance of the aorta; but it has most commonly consisted of narrowing of the left auriculo-ventricular orifice, and a rigid condition of the mitral valve."

When these morbid states exist, it is easily brought on by violent exercise, or anything that irritates the lungs.

Pulmonary hemorrhage may be *simple*, the blood being all spit up; or it may be attended with what is most improperly callad *pulmonary apoplexy;* that is to say an infiltration of blood into the minute tubes and air-cells, rendering a portion of lung solid. This, as Dr. Watson has shown, is an accident of pulmonary hemorrhage, and occurs in this way. A portion of the blood, instead of being coughed out, is drawn back by the patient's inspiratory efforts into one or more small tubes, and fills and blocks up one or more lobules; giving rise to one or more knobs or masses, composed of blood that has coagulated in the air-vesicles. Sometimes, though not often, the latter are broken down and ruptured by it. In other cases, hemorrhage occurs in the minuter tubes and vesicles, and goes on clogging up a large portion of lung progressively; there being not the circumscribed lumps just described, but a large irregular diffused solidification.

*Symptoms.*—Some degree of pain or oppression at the chest, with cough, which brings up mouthfuls of blood, fluid or clotted. The quantity may vary from a teaspoonful to several pints; so that the patient may be suffocated by the abundance of the hemorrhage.

The stethoscope is useful as indicating the extent and place of the hemorrhage, for wherever there is blood in the air-tubes or vesicles there will be a corresponding crepitation, or if the lung is solidified there will be absence of respiration.

After pulmonary apoplexy, the blood is expectorated in dark-red sputa, mixed with mucus.

*Treatment.*—When the pulse is full, strong, and vibratory, bleeding is required, and the quantity of blood abstracted will necessarily depend on the strength of the patient. One bloodletting of twenty or twenty-four ounces on the first or second day, will have more effect in checking the hemorrhage than several pounds taken away in the course of a fortnight. When the patient's powers will not admit of general depletion, cupping or leeches should be resorted to. A free current of cold air should be allowed to pass over the patient, who should be lightly covered; the bowels should be opened with Epsom salts and sulphuric acid; and the best remedy is the acetate of lead with opium. Perfect silence should be enjoined; the diet be very meagre, and comprise lemonade or other acid drinks. If the hemorrhage assumes a passive character, alum, with dilute sulphuric acid may be administered. In slighter cases, saline draughts, with small doses of digitalis, may suffice. Any inflammatory or irritative symptoms must be treated by blisters and other remedies that have been adverted to when speaking of phthisis.

### HÆMATEMESIS—HEMORRHAGE FROM THE STOMACH.

*Causes.*—Whatever irritates the mucous surface of the stomach, or interrupts the return of blood from that organ, will occasionally produce this disease. Blows and injuries on the abdomen, particularly on the hypochondria and epigastrium; violent concussions of the trunk; external or internal pressure on the stomach; the ingestion of irritating or hurtful matters into this viscus; intemperate indulgence in food or stimulating liquors; the presence of worms in the stomach or upper part of the small intestines; powerful or irritating emetics, especially when given in the advanced stages of fevers, or in cachectic or visceral diseases; the suppression of accustomed discharges, particularly the menstrual or hæmorrhoidal; the application of cold, or of cold and moisture, to the lower extremities or surface of the body during perspiration or the catamenial period; neglect of the bowels, and consequent accumulation of fæcal matters; diseases of the vessels of the stomach and neighbouring viscera; the gravid uterus, and large tumours developed in any part of the abdomen.

*Symptoms.*—In most cases, there are *premonitory* symptoms, such as tension or pain about the epigastrium, with faintness, or a sense of sinking, or of anxiety, at this region; flatulent or acrid eructations; lassitude with irregular chills and flushes of heat. The *pathognomonic* phenomena of the disease are, nausea, followed by vomiting of blood, either fluid or coagulated, pure, or mixed with the contents of the stomach. The blood and other matters thrown up come away with more or less effort, frequently with comparative ease, even when the hemorrhage is greatest, and seldom with much previous retching; it is sometimes gulped or eructated upwards.

When the quantity of blood thrown up is great, the effort at ejecting it may sometimes occasion irritation in the pharynx, and excite coughing, and, from this circumstance, cause some doubt as to the seat of the effusion; but the history of the case will easily show the nature of the disease. After an attack of hæmatemesis, the bowels are generally relaxed, and the dejections dark-coloured, from the presence of blood in them, and extremely fœtid. Sometimes the evacuations are quite black, and of the consistence and appearance of tar. This state of the evacuations (the *melæna* of old authors) often continues for some time after the vomiting has ceased; and they are often preceded by colicky pains through the abdomen, distension, flatulence, tormina, and even slight meteorismus.

The *physical characters* of this hemorrhage which require notice are merely those which are referable to the colour, consistence, and quantity of the effused blood. The blood effused into the stomach and intestines is seldom found to present its natural red colour, either when thrown out from these organs, or when contained in them after death. It has often acquired a dark purple, and still more frequently a deep brown tint, or even the blackness of soot. The dark brown and sooty discolorations of the blood may always be regarded as the result of the action of an acid chemical agent, formed in the digestive organs, on the effused blood, except in those cases in which they are produced by the action of an acid poison. Hence we may conclude, that the diseases called *black vomit* and *melæna* are mere modifications of gastric and intestinal hemorrhage, the black colour being an accidental circumstance of no importance, and derived from the chemical action of the acid product on the blood, previous to its evacuation. The *consistence* of the effused blood is very generally increased with the darkness of colour which it has acquired. It is sometimes coagulated into large masses, or into a multitude of smaller portions, resembling a mixture of water, blood, and soot. This appearance is peculiarly characteristic of the action of an acid on the blood. The *quantity* of blood effused may vary from a few ounces to several pints; and although it is generally greatest in cases of perforation of an artery of the stomach, it is sometimes no less abundant when it has its source in exhalation from the mucous membrane.

Of the different *local lesions* which are found to accompany gastric and intestinal hemorrhage, follicular ulceration is, perhaps, the most common. The mucous membrane may be perfectly pale when the hemorrhage has proceeded from perforation of an artery; red and vascular when preceded by congestion; or it may be of a deep red colour throughout a great extent, whatever be the source of the effusion, from imbibition alone. It almost always presents this deep red colour when the hemorrhage arises from a mechanical obstacle to the return of the venous blood, the submucous tissue

at the same time in a state of great congestion, and inflamed
blood.

atment.—In plethoric and young persons, in cases depending
ngestion of the liver or spleen, or upon suppressed discharges,
where there are indications of increased or sthenic action, we
t have recourse to copious or repeated *bloodlettings*, according
ircumstances. *Cupping* over the hypochondria, purgatives,
rific enemata, and external derivations, should be resorted to.
e more active forms, a full dose of calomel, followed in a few
s by a purgative draught, and this by a cathartic enema, so as
secure copious evacuations, should precede the use of
ngents. When the hemorrhagic discharge is so copious as to
t the delay which this practice would occasion, the calomel
ld be followed in a short time by a full dose of oil of turpentine,
on the surface of milk or of some aromatic water, or of this
cine conjoined with castor oil. If this draught be thrown off
stomach, it should be repeated: and it may be even again pre-
d by the calomel. Notwithstanding its usual nauseating effect,
entine is generally retained in hæmatemesis, and it allays the
ting by arresting the hemorrhage.

f the astringents, the acetate of lead, in large doses, with opium,
th pyroligneous acid, acetate of morphia, and creasote, is the
efficacious. In the more *passive* states of the disease, the
astringents, as the tincture of the chloride of iron, the oil of
entine with aromatics, the sulphates and sulphuric acid with
n and infusion of roses, and alum-whey, are generally useful.
ring the continuance of the discharge, total abstinence should
joined; but afterwards, mild mucilaginous drinks, and farina-
food in small quantity, may be allowed, and the transition to
and more nutritious diet carefully and gradually conducted.
rink should be cooling and astringent, and appropriate to the
of the digestive organs, especially the liver and spleen. Sub-
ntly, change of air, regular exercise on horseback, and the use
bstruent mineral waters, ought to be recommended.

### ATURIA—HEMORRHAGE FROM THE URINARY ORGANS.

*mptoms.*—The source of blood voided through the urethra may
her the kidney, ureters, bladder, or urethra. When it proceeds
an affection of the kidneys, it is attended with a sense of heat
ain in the loins, and sometimes with coldness of the extremi-
*nd the blood is intimately mixed with the urine.* When the
e is in the ureters, there is a sense of pain and tension in their
*; and coagulated shreds of fibrine, having the shape of the*
*, are frequently voided.* When the hemorrhage is from the
r, it is usually preceded by heaviness and tension above the
extending to the perineum, groins, and lumbar region; the

passing of the urine is attended with pain and difficulty; the blood is little, if at all, combined with the urine. When the hemorrhage is from the urethra, pain is felt in a particular part of the canal, and the blood is red, liquid, and pure, and generally is voided *guttatim.* When the blood, however, flows back into the bladder, some uncertainty as to its origin is produced.

Hemorrhage of the urinary organs presents little worthy of notice, as regards its *physical characters,* except when it occurs in the bladder. In this organ, it takes place from isolated points of the mucous membrane, which, as well as its sub-cellular tissue, presents a number of deep-red patches, varying from a line to half an inch in diameter, the larger ones having often a small ash-coloured slough in their centre. These patches consist of blood effused into the mucous and sub-mucous tissues, and are accompanied by venous congestion of those tissues where the effusion has not taken place. This form of hemorrhage is chiefly observed in injuries of the spine; and appearances perfectly similar sometimes follow the application of blisters to the chest, abdomen, and other parts of the body. The most frequent cause of hemorrhage from the urinary organs is the presence of the fungoid disease in the prostate, and hence its much greater frequency in the male than in the female.

*Treatment.*—The treatment of this affection will, of course, depend on its seat and cause. When the hemorrhage is from the kidney, if the patient be strong, and the pulse full, either general or local depletion, with the usual antiphlogistic treatment, is requisite. On the contrary, when the patient is debilitated, as in typhus or scurvy, the urine being generally alkaline, the mineral acids should be given. In ordinary cases, when neither excitement nor depression is present in a marked degree, small doses of copaiba, turpentine, or of the *tinct. ferri chlorid.*, the latter of which is the best, are to be administered. The avoiding of all stimulants, and absolute rest, should be insisted on.

## DROPSIES.

If, in man, a large venous trunk be compressed or obliterated, so that the blood no longer circulates through it, whilst at the same time the collateral vessels can relieve but imperfectly the principal vein thus obstructed, an effusion of serum is sure to take place. But if the obstruction exists not merely in the veins of a limb, if it occur in a vessel into which the blood of a much greater number of parts empties itself, then the dropsy will necessarily become more considerable. If, for instance, the obstacle to the return of the blood should exist in the abdominal vena cava, the two lower extremities, as also the scrotum, will become filled with serum. If it be the trunk of the vena portæ which is more or less completely obliterated, it is in the peritoneum that the serous collection will first take place; it is in this way we may suppose that certain diseases of the liver become causes of ascites. If, in fine, the obstacle to the free return of venous blood exists at the very centre of the circulation, namely, at the heart, we must then draw the theoretical conclusion, that in this case, the circulation of the venous blood being everywhere embarrassed, serous collections must form in all directions, and the dropsy become general. This case, anticipated by theory, is actually established by experience; all practitioners know *that dropsy is one of the most common symptoms of the different organic affections of the heart.*

The next cause of dropsy is *cold*, applied in such a manner as to check the secretion of the skin. From this cause we have frequently general anasarca, and effusions into the pleuræ, the pericardium, the peritoneum, &c. These cases are, from the attendant constitutional symptoms, called *inflammatory dropsy.* A *third* cause of dropsy is some exanthematous disease, and especially scarlatina. A *fourth* cause of dropsy is the granular degeneration of the kidney, first pointed out by Dr. Bright, and elucidated by the admirable researches of Dr. G. Johnson, of King's College.* A *fifth* source of dropsy is debility, exhaustion from loss of blood, &c. A *sixth* and frequent cause of dropsy is obstruction to the flow of the venous blood, owing to tumours pressing on the large venous trunks, and glandular enlargements, as hypertrophy of the liver, &c.

The presence of *albumen in the urine* depends on the presence of *blood*, or else of the *serum of blood.* If serum only be present, the albumen may be detected by boiling a portion of urine, and adding nitric acid; if the entire blood be present, the red particles may be detected by the microscope, and will render the urine *smoky* or dusky in colour.

These conditions of the urine in dropsy depend on a congested, or irritated, or diseased state of the kidney, so that the capillaries of the Malpighian bodies either exude serum, or else are ruptured and pour out blood.

### NEPHRITIC DROPSY—DROPSY FROM BRIGHT'S KIDNEY.

Dr. Bright first pointed out, in 1827, the frequent connexion which exists between dropsy and what has since been called granular degeneration of the kidney, and the presence of albumen in the urine, as an indication of the latter lesion; but it was reserved for Dr. G. Johnson, of King's College, to detect the real nature of this most prevalent and fatal disease.

*Pathology.*—This state of the kidney is not an inflammation, but a slow *degeneration of structure*, commencing by an abnormal deposit of fat in the epithelial cells lining the uriniferous tubes. It is a degeneration, therefore, much allied to the tubercular deposit, or to the fatty liver common in phthisis, and may properly receive the name of the *fatty kidney*. It is a slow insidious disease, beginning generally much further back than the patient is aware of.

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* See two excellent lectures, by Dr. Todd, of King's College, in the *London Med. Gaz.* Dec. 19th and 26th, 1845.

The uriniferous tubes become by degrees blocked up with an excessive accumulation of fatty epithelium; the result of this is, that the tubes become dilated, so as to press on the portal plexus of veins which surround them. The veins being thus compressed, the Malpighian capillaries, which open into them, are unable to discharge their contents, and so become distended with blood; and either allow serum to exude from their walls, or else burst and admit the escape of red particles and fibrine. As the accumulation goes on, portal plexuses and uriniferous tubes become atrophied, and hence, shrinking of the kidney and deficiency of secretion ensue. As, however, some Malpighian tufts remain healthy, the secretion from these is sometimes abundant, or even excessive.

The *morbid anatomy* is thus described and explained by Dr. Todd:—

1. "Both kidneys are found in a diseased state. It seldom or never happens that the disease is limited to one kidney.

2. "We meet with irregular vascular congestion, the vessels are full at some parts of the organ, and empty at others, and this gives rise to a mottled appearance on the surface of the kidney.

3. "A deposit of a new matter is found either in or between the tubes of the kidney; this deposit has hitherto been called *granular*.

4. "As the disease advances, the kidneys, which at first were enlarged, shrink, their cortical or external portion becoming wasted, here and there leaving depressions on the surface of the organ, corresponding to the wasted portions; and thus a tuberculated aspect is given to the kidney. The blood-vessels are obliterated in many situations, and it is impossible to inject such kidneys."

*Constitutional Symptoms.*—These may be divided into three stages.

In the first, the patient is weak and dyspeptic; and his *blood loses its red particles* in an extraordinary degree; but there is very little to call attention to the kidney.

In the second stage, the symptoms are, a pallid, pasty complexion, dry hard skin, drowsiness, weakness, indigestion, and frequent nausea, often retching the first thing in the morning, and palpitation of the heart. A most characteristic symptom is, that the patient is awakened once or twice in the night, with desire to make water.

In the third stage, if the patient is exposed to cold, the kidney becomes congested; anasarca with, perhaps, ascites, makes its appearance; debility increases; the secretion of urine becomes more inefficient, urea and other excrementitious matters accumulate in the blood; and drowsiness and coma, signs of effusion into the head, are sure precursors of death.

*Of the state of the urine.*—In the first stage, if examined, it will often be found to contain particles of epithelium, loaded with fat.

In the second stage, the urine is *albuminous*, and not only so, but contains sometimes red particles of blood, and little *fibrinous shreds*, moulds of the tubuli uriniferi, in which they have coagulated. Its *specific gravity is generally very low;* instead of 1025, the healthy average, it sinks to 1016, and gradually gets lower; down, perhaps, to 1004. It will often be found under the microscope to contain a large amount of fatty epithelium scales.

In the last stage, the quantity of urine is very variable; sometimes very scanty, or even suppressed, so that the patient dies comatose, from the urine retained in the blood; sometimes extremely abundant; and sometimes before death the albumen entirely vanishes.

*Consequences.*—This fatty disease of the kidney, besides dropsy, and fatal coma, is apt to induce acute inflammation of the serous membranes, disease of the heart, and obstinate indigestion.

*Causes.*—It may be caused by intemperance, privation of air and light, and neglect of proper exercise; frequent exposure to cold, and the other causes of scrofula and phthisis.

*Treatment.*—If the disease assumes an *acute* character, with pain in the loins, fever, and evidence of renal congestion, cupping should be performed on the loins. But in most cases the treatment should be so conducted as to keep the emunctories open, and reduce the strength as little as possible. The skin should be kept open by baths; the bowels by saline purgatives; and in the intervals of purgation, the kidneys should be solicited by the milder kinds of saline diuretics, such as tartarized soda. When there is an absence of fever the tartarized iron can sometimes be borne. Lastly, the diet should be plain and as nourishing as the stomach will digest, and fatty matters should be excluded from it as much as possible.

## HYDROTHORAX, DROPSY OF THE PLEURAL CAVITIES.

It was formerly the common opinion, and is even now believed by many, that *idiopathic* hydrothorax is a very common disease, producing a formidable array of symptoms, and often causing death by suffocation. In late years, the erroneousness of this opinion has been shown, on the one hand, by the study of pathological anatomy, which has discovered, in the supposed cases of simple hydrothorax, extensive organic disease, without any effusion; and, on the other hand, by auscultation and percussion, which have not only proved the same during life, but have likewise taught us that hydrothorax, when it does exist, can have but a very small share in producing the symptoms that have hitherto been ascribed to it.

*Symptoms.*—The patient feels an oppression and difficulty of breathing, and generally lies on the affected side, leaving the healthy one unencumbered in its functions. When the fluid is in both cavities, the respiration is still more difficult and short; the patient sits up in bed, and calls in the aid of all the muscles of inspiration; and his countenance assumes a cast of anxiety. Corvisart describes the chest as being more distended and rounded on the side which contains the fluid; and as the collection increases, the intercostal spaces are widened, the integuments of this side becoming œdematous, and in a few instances, the arm on the same side. In the acute states of this disease, a feeling of soreness, tenderness, or pain, is often complained of in or over the seat of effusion. *Symptomatic* hydrothorax will combine with the common signs of pleuritic effusion those of whatever organic disease it is the consequence; and this will generally be found to be some lesion of the circulatory apparatus, by which its function is extensively impeded. Laennec states that it scarcely ever supervenes earlier than a few days before the fatal termination of such diseases, and may therefore be considered the immediate harbinger of death, the agony of which it increases by dyspnœa.

*Physical signs.*—On *percussion*, a flat sound is emitted, resembling that produced by striking the thigh, on the side containing the fluid, or on both sides when the effusion has taken place into both. When the patient sits, or stands up, and the fluid only partially fills the cavities, the lower part of the thorax only will give out a dead sound. This sound generally changes its place with the change of position, owing to the gravitation of the fluid to the depending part. This, as M. Piorry contends, is an important diagnostic between the dead sound of effusion and that produced by hepatization of the substance of the lung, which always retains the same situation. Upon *auscultation*, the respiratory murmur is found to have ceased in the region corresponding to the fluid collection; and in its place is heard the *bronchial* respiration. When the effusion is not very great, *ægophony* is occasionally heard. If the fluid be accumulated only in one cavity, *mensuration* of the thorax then becomes a useful mode of diagnosis; but the increased fulness of one side, and widening of the intercostal spaces, may be recognised at sight.

*Treatment.*—The plan of treatment must depend upon the cause of the effusion, which may be, an organic lesion of the heart or lungs, or inflammation of the pleura; and these are to be managed on the general principles laid down when treating of those affections. *Cathartics* and *purgatives*, especially the hydragogues, often afford speedy relief; but they are admissible only when the powers of life are not greatly reduced, and in the more acute cases, not caused by inflammation of the pleura. *Diuretics* are more certainly beneficial in this dropsy than in any other; and of this class *digitalis* is the most efficacious, particularly in the form of infusion. All authors agree in admitting the power of digitalis in this affection. Where there is much prostration of vital energy, we should combine *tonics*, and *antispasmodics*, with the diuretic medicines. *Paracentesis thoracis*, once so strenuously advised, is seldom or never resorted to, excepting in empyema. The chief danger in this operation proceeds from the introduction and action of the air; but not so much from its preventing dilation of the lungs as from its action on the diseased pleura and the fluid effused from it, which becomes putrid and poisonous.

### ASCITES—DROPSY OF THE ABDOMEN.

Ascites, or dropsical effusion within the abdomen, may exist either alone or complicated with hydrothorax and general anasarca.

*Causes.*—The great extent of the peritoneum, the number and importance of the viscera with which it is connected, and of the absorbent glands it encloses, the numerous sources of disorder to which these organs are exposed, the great number and weakness of the veins which transmit their blood to the portal vessels, and the absence of valves from them, in some measure account for the frequent accumulation of fluid in this cavity. Ascites may arise at any age. Camper, Lee, and others, have observed it in new-born infants; but it is most common in women and aged persons. It occurs more frequently in married than in unmarried females; and is often the consequence of the distension and pressure attending pregnancy, of difficult or instrumental labours, and of suppression of the puerperal secretions, or of the perspiration, of catamenia, or of the disappearance of this last evacuation.

*Pre-existent disease* is generally the cause of ascites, particularly diarrhœa or dysentery, and sudden interruptions of these discharges; intestinal worms; organic lesions of the liver and spleen, especially obstructions of their venous circulation; inflammation of the vena portæ, and obliteration of one or more of its principal branches; the suppression of chronic eruptions, or of the exanthemata,—as scarlet fever, erysipelas, &c.; acute or sub-acute peritonitis; organic change of the structure of the kidneys; the rupture of cysts into the abdomen; uterine or ovarian disease; intermittent or remittent fevers; excessive evacuations and hemorrhages.

*Symptoms.*—Idiopathic ascites generally assumes an *acute*, or even *inflammatory* form. It usually occurs either in the young, the robust, or well fed, and presents all the symptoms of the phlogistic diathesis; the pulse is hard, thirst increased, the urine scanty; the skin is warm, hot, or coloured, and resists more or less the pressure of the finger. There are evidences of inflammatory or excited action of the peritoneum, with pain, tenderness, and sometimes tension of the abdomen; a quick, small, hard, or wiry pulse, and suppression or diminution of all the secretions or excretions. Either consecutively on, or concomitantly with, these symptoms, fulness of the abdomen is observed, which usually augments rapidly. At first, the increase is most remarkable in the lower part of the abdomen and iliac regions when the patient is sitting up, and the liver is not enlarged; but it is always diffused when the patient is in the supine posture, and without any limitation or tumour. Upon examining the abdomen, a dull sound is emitted by percussion, and fluctuation is easily perceived. As the effusion augments, all the abdominal functions are more and more disturbed, and at last respiration becomes difficult from the pressure of the fluid impeding the descent of the diaphragm, and the patient is unable to lie down. The abdomen is now large and prominent in its upper regions, and pushes, particularly in young subjects, the ribs and cartilages upwards. Irritability of the stomach, anxiety, restlessness, want of sleep, great quickness of pulse, sometimes delirium, and ultimately coma and death, supervene, if temporary or more prolonged relief be not obtained from treatment.

Ascites may be mistaken for tympanitis, ovarian dropsy, and for pregnancy. *Tympanitis* is readily recognised by the clear resonance furnished on percussion, by the absence of fluctuation, and of the œdema of the lower extremities, and by the history of the case. *Ovarian dropsy* is never general or uniform in its earlier stages, like ascites; and fluctuation is usually very obscure, and to be detected only in the situation of the tumours, the circumscribed form of which may be determined until a very advanced period of the disease. *Pregnancy* is distinguished from ascites by the state of the os uteri upon examination, by the progress of the enlargement, and the defined form of the uterus when the patient is supine, and the abdominal muscles relaxed; by her unbroken health and clear complexion,—the countenance of dropsical persons being pale, sickly and cachectic; by the enlargement and firmness of the breasts, and the deep colour of the areolæ,—these organs being soft and flabby in ascites.

Let the patient lie on the back, and percuss the abdominal parietes; in ascites, they generally yield a dull sound towards the back, where the fluid settles, and clear in front, because the bowels float upwards through the serum. It is the reverse in pregnancy and ovarian dropsy.

*Treatment.*—This must depend, as in other dropsies, upon the organ affected, and upon the extent and nature of the disease. The long residence in tropical countries, which causes the liver to act inordinately in order to eliminate the excess of carbon from the blood, this gradually produces congestion, which ends in inflammation. The excessive use of alcohol acts much in the same way. Miasmata likewise produce it; so also do disease of the heart, duodenal inflammation, and dysentery.

*Morbid Appearances.*—When the substance of the liver is inflamed, it becomes brittle and friable; the granulations are larger and more red than natural, and the lining membrane of the biliary ducts is injected and of a reddish-brown colour. In most cases, abscesses are found in different parts of the liver, or the greater part of the organ may be converted into one large cyst containing pus. In other cases, the purulent matter is infiltrated into the substance of the gland. Dr. Budd has called attention to the fact, that the abscesses in the liver, following dysentery, are often owing to an inflammation of the hepatic veins.

*Treatment.*—General and local bleeding, mercurial and saline purging, diaphoretics, &c., with an earlier resort to the constitutional impression of mercury than in most other phlegmasiæ. The especial tendency of this medicine to the liver is owing to its entrance into the vena portæ.

### CHRONIC HEPATITIS

Is denoted by more or less pain and tenderness, or weight and fulness, in the right hypochondrium, with sallowness of the skin, emaciation, and depression of the spirits. It may be a consequence of acute inflammation, or of long residence in unhealthy climates, or of diseases of the heart; one very frequent cause is *intemperance.*

Sometimes the liver increases greatly in bulk, and may be felt low in the abdomen, or its limits be ascertained by percussion. Sometimes, on the contrary, it is shrunken and atrophied.

One common form of disease, which is often a precursor of ascites, is what is called the *hob-nailed liver.* This disease originally consists in an inflammatory thickening of Glisson's capsule, which forms a sheath for the portal vessels, the hepatic artery, and biliary ducts. The thickening of this cellular sheath may compress the biliary ducts, and so cause jaundice; or the portal veins, and so cause ascites. Finally, the thickened cellular sheath shrinks and becomes atrophied, and by its shrinking compresses the hepatic artery, and so causes general atrophy of the organ; whilst by its shrinking it leaves the lobules projecting as little rounded eminences like the heads of nails.

The appearance called *nutmeg liver*, is a mere consequence of congestion. If after death the hepatic vessels, which run in the centre of each lobule, are injected, the liver presents on its surface us red spots, with pale interstices. If, on the contrary, the system only is injected, it will display pale spots correıg to the lobules, with red interstices.

*tment.*—The general rules in treating chronic hepatic dis- ɜ, to diminish congestion of the portal vessels; to keep up ;retion of the urine, to allay irritation, and support the h. Small doses of mercury with squill; saline aperients, ıretics; taraxacum; sulphate of manganese; muriate of ia; iodine; colomba, and other light tonics; nitro-muriatic .ven internally, and used as a bath for the legs; occasional g, blistering, or frictions with mercurial ointment, or with Cheltenham waters; and a light nourishing diet, are the ɜmedies.

### IOSIS, OR GRANULAR DEGENERATION OF THE LIVER.

ıis disease, the liver becomes filled with granulations of differzes, not tuberculous, projecting beyond the surface. It is contracted in size, and of a yellowish-brown, or even a ca- ›lour.

*ıre.*—Not perfectly understood. The ultimate cells appear ete an abnormal matter, which possibly may be a morbid on of fat. The cells then enlarge, and press upon the acini, ɔ cause their absorption.

*symptoms* are not very obvious, hence it often escapes detec- There are often dyspeptic symptoms with some uneasiness in pochondriac region, with, ultimately, dropsical effusion. The ·erate are especially liable to it.

*treatment* should be similar to that of chronic hepatitis.

### FATTY DEGENERATION OF THE LIVER.

liver is here generally enlarged, the surface of a bright- colour, smooth, with reddish specks throughout. When cut greasy stain is left upon the knife. The cells are filled up ı oily matter.

*cause* depends upon some depraved condition of the ultimate ion, whereby fat is produced, instead of the normal secretion; rs chiefly in the intemperate, and in phthisis.

*treatment* consists in invigorating the general system; cod- l is indicated, just as in phthisis.

·r organic diseases of the liver, which it will be sufficient here tion, are *tubercle*, *scirrhus*, *cysts*, *hydatids*, and *melanosis*, the is of which, during life, is very obscure.

## FUNCTIONAL DISORDER OF THE LIVER.

### CONGESTION OF THE LIVER.

*Active* congestion may depend on the same causes that produce inflammation; *passive* congestion is caused by some obstruction in the portal circulation, or from valvular disease of the heart.

*Signs.*—Often enlargement; a sense of oppression; lowness of spirits; loss of appetite; nausea; furred tongue, &c.

It is apt to produce congestion of the whole portal system; hence it frequently ends in diarrhœa, dysentery, enteritis, or cholera morbus.

*Treatment.*—In the active form, bleed and give a mercurial purge; and, if persistent, use mercury in alterative doses. In the passive form, endeavour to remove the cause, and use the alterative course of mercury, or nitro-muriatic acid.

### DERANGED SECRETION OF THE LIVER.

It may be excessive, or deficient, or morbid; in each of which cases, the particular condition is ascertained by inspection of the stools. These will be copious and of a bilious character, if the secretion is excessive; but small, clay-coloured and dry, if it is deficient; or black, or intensely green, if it is deranged.

The *treatment* in all cases consists in giving minute doses of calomel or blue-pill, and opium, as one-sixth grain of calomel with one-twelfth grain of opium, every hour, until two grains of the mercurial are taken; and follow, the next day, with a saline laxative.

### GALL-STONES.

Gall-stones may exist in any part of the biliary passages; they are also extremely various both in size, number, and shape. They may so entirely fill up the gall-bladder, as to excite ulceration and fatal peritonitis. The *causes* of gall-stones are obscure, but their formation is frequently connected with imperfect assimilation of the nutriment. They are composed of the colouring matter of the bile and of cholesterine.

*Symptoms.*—Biliary concretions often pass into the duodenum without causing any disturbance; on other occasions, the patient is suddenly seized with acute pain in the right hypochondrium, increased on the slightest motion, and shooting backwards under the scapula; the pain is increased after meals. There are also nausea, vomiting, distention of the abdomen, and alternations of diarrhœa and constipation. The paroxysms occur at irregular intervals; the pulse is commonly natural, and the skin cool.

*Treatment.*—The treatment of biliary calculi, or rather of the irritation produced by their passage into the duodenum, is mer-palliative. Opium, or its salts, should be frequently administered, to relieve the agonizing pain, which is frequently the most prominent symptom, and warm anodyne fomentations should be applied to the abdomen; the inhalation of ether has often given prompt relief during the paroxysm. Dr. Prout recommends large draughts of warm water containing carbonate of soda in solution. The warm bath will also be useful in allaying spasm. When we have reason to think that the gall-stones have been evacuated, the patient should be ordered to take a course of vegetable bitters, and occasionally alkalies; the diet should be light, and a sojourn at some of the watering-places should be recommended when circumstances will permit.

### JAUNDICE.

The term jaundice is applied to a yellowish tinge of the skin and eyes, depending on the presence of bile in the circulating fluids.

*Causes.*—These are, diseases of the liver; obstruction to the free passage of bile into the duodenum; congestion of the portal system, or excessive secretion of bile; gastro-duodenitis, &c.

*Symptoms.*—The symptoms of jaundice will evidently depend on the nature of the cause which has given rise to the unnatural colour of the skin. The yellow tinge is the most prominent sign: it usually commences in the face, and thence may extend over the whole body, being most clearly distinguished underneath the conjunctivæ. The digestive functions are deranged; the bowels usually costive, and the fæces untinged by bile; the urine is high-coloured, and more or less of a saffron tint; the tongue is foul and covered with a yellow fur; the patient complains of headache, and very often of pain in the region of the liver. The condition of the pulse is extremely variable, and the skin is usually dry, with a sense of itching or stinging.

The morbid appearances found in persons who have died with jaundice depend on the causes which have produced the disease; and they may be deduced from the enumeration of those already given.

*Treatment.*—The indication is to restore the hepatic secretion. First ascertain whether the liver be irritated or torpid; if the former (as denoted by pain in the side, increased by pressure), cup or bleed, give a mercurial purge, and follow by alterative doses of mercury; if the latter, which is the most common, give a brisk mercurial cathartic, and follow it by mercurial alteratives. These are to be followed, if necessary, by alkalies, taraxacum, nitro-muriatic acid and aloes. Often there is a languid state of the digestive organs for which the bitter tonics are required. In chronic cases, a resort to the watering-places will be beneficial.

### SPLENITIS.

*Signs of acute splenitis.*—Pain in the left side, of a sharp or dull character, increased by pressure, coughing, or a full inspiration, and also by lying on the affected side; there are also chill and fever. It may end in suppuration. It is liable to be mistaken for inflammation of the left lobe of the liver.

*Causes.*—External violence, suppression of habitual discharges, congestion of the portal circle and depressing emotions.

*Treatment.*—In the sthenic cases it should be decidedly antiphlogistic; in the asthenic, local bleeding and revulsives, but *not* mercury; if connected with miasmatic fever, quinine is indicated.

*Chronic splenitis* sometimes lasts for years; it is very apt to end in dropsy. It is often connected with a cachectic condition, especially in the residents of miasmatic districts. The enlargement of the spleen is sometimes excessive.

It is usually an original disorder, arising from repeated attacks of intermittent fever, which, by producing successive congestions in the organ, occasion a permanent enlargement.

*Treatment.*—Purging by jalap and cream of tartar; calomel, only, in case the liver is torpid, quinia, iron, and iodine,

The spleen is also liable to similar *organic* diseases with the liver.

## NEPHRITIS.

*Inflammation of the kidney* may occur either in its substance, its lining membrane, or in its capsule; its most frequent seat is in the pelvis.

*Signs of the acute form.*—Deep-seated pain in the small of the back, extending down to the groins on one or both sides, increased by pressure; urination either increased or diminished; urine scanty and high-coloured, and mixed with blood or gravelly matters. If both kidneys are affected there may be suppression of urine, and comatose symptoms. Chill, fever, deranged stomach, and constipation nearly always attend it. In inflammation of the substance of the kidney the urine is apt to be clear; if the pelvis is involved, the urine is turbid; in gouty nephritis it contains an excess of uric acid, and is high-coloured. It may terminate in suppuration or in coma.

*Diagnosis.*—It is distinguished from lumbago, psoas abscess, and peritonitis, by the retraction of the testicle, by the pain shooting down into the scrotum and thigh, and by the altered character of the urine.

It very rapidly runs into suppuration, the sign of which is the appearance of pus in the urine.

In *chronic nephritis* the pain is dull; the diagnosis is made chiefly from the character of the urine, as its alkalinity and excess of epithelium scales.

*Cause.*—External violence, as blows, &c., and the action of irri-

### DIURESIS.

This term is used to signify a morbid increase of urine; it is synonymous with the *diabetes insipidus* of authors.

The natural quantity of the urine varies according to the season of the year, the amount of fluids drunk, the flow of perspiration, &c. *Thirst* is a usual accompaniment, either as an effect or cause. Diuresis frequently attends hysteria. The urine is pale, and of a low specific gravity.

The *treatment* depends on the cause. Excess of drinking should be avoided, and also salines and stimulants. Diaphoresis should be promoted by the use of warm baths, the use of the flesh-brush, and exercise; Dover's powder at night; tonics and iron if attended with anemia; and in debility the alterative diuretics; as copaiva.

The *albuminous* diuresis occurs chiefly in Bright's disease. In another form of the disease there is an excess of urea; this arises either from a bad assimilation of the food, or from a too rapid disintegration of the tissues. The *test* for urea is nitric acid, or the microscope. It is usually accompanied by a morbid appetite, and great emaciation; it is a dangerous disease.

The *treatment* is to correct the defective digestion by the use of mineral tonics, especially nitro-muriatic acid, also the milder diuretics.

### ISCHURIA, OR SUPPRESSION OF URINE.

It frequently attends inflammatory diseases, especially acute nephritis. It may arise either from an irritation of the kidney beyond the point of secretion, or from a torpor or paralysis of the kidney. It is important to distinguish it from *retention of urine.*

Suppression is sometimes very dangerous, being attended with vomiting, drowsiness, coma, and convulsions. In other cases a vicarious secretion is established, as from the skin, bowels, &c.

The *cause* of suppression is not certainly known; it has been attributed to a sort of paralysis of the nerve-centres.

*Treatment.*—Copious bleeding, cupping over the loins; diuretics, as cream of tartar, digitalis, and squill; the free use of demulcent drinks. If uric acid be in excess, give carbonate of potassa; if dependent on a torpid condition, use the stimulating diuretics, as turpentine and cantharides.

### LITHIASIS, OR GRAVEL.

This disorder consists in the deposition from the urine, within the body, of an insoluble sand-like matter. In health the urine carries off the results of the waste and disintegration of the tissues in a soluble state; but when these matters are in excess, the urine

*Treatment.*—In the uric acid form, the alkalies are indicated, especially bicarbonate of soda given in carbonic acid water; also mild diuretics, and the free use of diluents; strict attention to diet; a very sparing use of animal food, avoidance of alcoholic drinks, and of all acescent and indigestible articles of food; the warm bath; and moderate exercise.

In the phosphatic variety, the treatment appropriate for dyspepsia is indicated; the mineral acids; the alkaline *bicarbonates* act by dissolving the phosphates; opium is specially indicated; stimulant diuretics to alter the character of the mucous surfaces; warm clothing.

The oxalic variety requires a general tonic treatment. Dr. G. Bird recommends sulphate of zinc, and in anæmic cases the chalybeates, and also colchicum. All articles of food containing this acid should be avoided.

### INCONTINENCE OF URINE.

This may depend upon two different conditions: an excessive irritation of the bladder, it not being able to hold the urine; or a debility or paralysis of the sphincter muscle. Both conditions may occur at one time. The most common cases of incontinence are where the sphincter retains considerable power, but yields habitually to a slight impulse, especially in sleep, when the will cannot act. It is sometimes attended with an acrid state of the urine, which is high-coloured, and often loaded with uric acid. Again, in other cases, there appears to be a debility of the kidneys.

*Treatment.*—The indications are to invigorate the general system, and to give tone to the sphincter. A course of tonics, sea-bathing, cold bath, warm clothing, &c.; together with astringents and stimulant diuretics, especially the tincture of cantharides, pushed so as to produce slight irritation. Small doses of extract of belladonna have also been highly recommended.

In cases of paralysis of the bladder, applications to the spine, strychnia, electricity, and powerful local irritants, have proved beneficial.

## SECTION V.

## DISEASES OF THE NERVOUS SYSTEM.

### HYDROCEPHALUS—ACUTE. TUBERCULOUS MENINGITIS.

*Hydrocephalus* is a name likely to mislead the student, as it signifies merely *dropsy of the brain;* whereas, the disease which it is used to designate, is an acute inflammation of the brain and its either are raised to the head, or the child picks its nose or mouth. The stupor is occasionally interrupted by loud and shrill screams from the child; and partial contractions of some of the limbs begin to manifest themselves.

*Third stage.*—The last stage now comes on; the pulse is quick, thready, and weak; there are partial or general convulsions; and paralysis of one side or limb occurs. The pupils become more and more dilated, the eyes suffused, and the cornea dull and filmy. The patient is either comatose or delirious, rolls his head about on the pillow, grinds his teeth, and moans or breathes heavily and quickly. The skin becomes cold and covered with perspiration, or the sweating may be partial; the respiration is irregular, or stertorous. The excretions are passed involuntarily, and the patient generally dies in a brief convulsive fit.

*Morbid appearances.*—The characteristic peculiarity is the existence of numerous minute tubercles, of a grayish or yellow colour, scattered over the surface of the brain, in the substance of the pia mater; sometimes the tuberculous matter is in large masses. The free surface of the arachnoid exhibits few signs of inflammation. The pia mater is inflamed, being injected, thickened, and infiltrated, and often exhibiting a deposit of a thick, yellowish matter, supposed to be coagulable lymph or pus.

The cerebral substance is congested; the convolutions flattened, and even at times quite effaced; the cortical portion is reddened, and the medullary portion, when cut, appears as if sanded over with red specks. The ventricles usually contain an abnormal quantity of serum, which may amount to several ounces; but other cases do not present this lesion, proving that the effusion is not essential to constitute the disease.

Tubercular deposits are also found in various other parts of the body, in a vast majority of cases.

*Treatment.*—This should be strictly antiphlogistic, and should be resolutely employed at once. Blood should be freely drawn from the arm; below the age of five, it will be more prudent to apply leeches to the temples or behind the ears; but some physicians deem it right to abstract blood from the arm, even in children of three or four years of age. The abstraction of blood must be followed up by free purging; and as the bowels are always constipated, recourse must be had to the most active purgatives, especially calomel and scammony; in many cases, the administration of croton oil will be found necessary to obtain evacuation of the bowels. During the employment of these means, the head should be shaved, and kept cool by the constant application of cold lotions. Calomel may be administered in small regular doses, till it causes green stools like chopped spinach. Great excitement or delirium may be mitigated by giving very small doses of tartar emetic in solution.

seventeenth and eighteenth centuries, has been recently revived by Sir Gilbert Blane; while the happy results of puncture, through the anterior fontanelle, sufficiently justify us in having recourse to this operation as a probable means of cure. Compression should be well kept up after the operation.

### ENCEPHALITIS—CEREBRITIS—INFLAMMATION OF THE BRAIN.

*Causes.*—Long exposure to a vertical sun, anxiety of mind, the inordinate use of ardent spirits, cold, fright, external injury, the sudden disappearance of an old discharge, &c., may produce this disease; it sometimes occurs as consequent on small-pox, or erysipelas of the face and scalp, and fevers, especially those of a typhous character, &c.

*Symptoms.*—Violent inflammatory fever, hot and dry skin, flushed countenance, suffused eyes, quick and hard pulse, throbbing of the carotids, and delirium. The senses are morbidly acute, there being intolerance of light and sound. The person is extremely restless; there is jactitation of the limbs, and rigidity of the muscles; the head is remarkably hot, the pupils contracted, and the excretions and secretions are suppressed. Occasionally, the muscles of the face are spasmodically affected, the upper eyelid hangs down, and the commissures of the lips seem to be drawn to one side. The tongue is white, loaded, red at its edges, and the papillæ elevated; there are nausea, vomiting, and obstinate constipation of the bowels. This last symptom is common in congestion, or inflammatory affections of the brain.

As the disease advances, all these symptoms are reversed; the morbid acuteness of the sensations changes into blindness and deafness; the delirium passes into stupor, and gradually into coma. Convulsions and different forms of paralysis ensue; the countenance is vacant or idiotic; the eye loses its lustre; the pupils become dilated; and occasionally there is strabismus. The respiration is now irregular, occasionally stertorous, the articulation imperfect, the pulse frequent and small, the limbs spasmodically convulsed or paralytic; there are retention of urine, and involuntary discharge of the fæces. In the still more advanced stage the countenance becomes pale and sunken, the pulse weak and irregular, the urine passes off involuntarily, the skin becomes cold and clammy, the coma more profound, and death soon closes the scene.

*Morbid appearances.*—The inflamed part of the brain presents different appearances, according to the time the disease has lasted. When it is only of some days' duration, the white substance, and still more perceptibly, the gray, exhibits a rosy, or slight red colour; and in it we perceive several vascular filaments. The firmness of the affected part is considerably diminished, and when cut

into, the surface of the incision pr
points, which cannot be removed by a
stage of encephalitis, the brain is re
strongly marked, and the softening
some cases, the blood becomes so inti
substance, that its colour approaches
of a deep dusky red; there is no actu
consider as such some small dots, a
which we occasionally find in some p
the brain is in a state of extreme *ra*

Should it happen that the inflam
without causing death, then the part
its softness, and ultimately becomes
state; it retains for some time its re
a dusky yellow.

The third stage of encephalitis i
colour gradually disappears, and the
purulent fluid, which is infiltrated in
combines with it, and gives to it, acc
mixture, a grayish, dull white, or y
times the pus is found in small isola
distinct cavities form, and occasion
ties uniting to form a large one. In
enclosed in cysts, in which case the
same characters as that found in the
The gray substance is the most usua
parts most commonly affected are,
lami, the convolutions, pons Varolii,

*Treatment.*—In this case, the mos
recourse to. The patient should be
cope; the head should be shaved, an
or cupping to the nape of the neck.
loss of blood in this case, and it is
syncope, owing to the excited cond
continued determination of blood to
applied to the head, and this treatm
meningitis, and meningo-encephaliti
erysipelatous forms. The bowels sh
instance by a large dose of calomel,
cynth, followed in about two hours
aided in some instances by a purgati
proper action of the bowels, repeate
exhibited, either in combination with
timonial; and its action should be

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* These small red spots differ from those of con
appear, as soon as the first are wiped away.

quickly as possible. During the progress of the disease, enemata and brisk cathartics should occasionally be administered. In the advanced form, should there be deep coma, blisters to the scalp have been recommended.

Blisters, however, should never be applied in this situation, unless there is profound sopor, weak action of the carotids, and no remarkable increase of temperature of the head. If applied in the earlier stages they seem to add to the excitement. Sinapisms may be applied to the feet, or inner sides of the legs or thighs; blisters are generally applied to the nape of the neck, or between the scapulæ.

## DELIRIUM TREMENS—DELIRIUM C. TREMORE—MANIA A POTU.

The *brain fever of drunkards* (Armstrong) is variously modified, according to the causes in which it originates, and the habits and constitution of the patient. It may, however, be divided into two species—the one being evidently connected with inflammatory irritation, or with excited vascular action in the meninges of the brain, and associated with great irritability; the other consisting chiefly of this last state, attended by exhausted nervous energy. The former occurs usually after a protracted debauch; the latter from the suspension of the stimulus in more habitual drinkers.

*Symptoms.*—The phenomena of this disease vary remarkably, from the slightest forms of nervous tremor, with spectral illusions and accelerated pulse, to the most alarming state of vital depression, muscular agitation, and mental alienation. In ordinary cases, it is characterized by constant watchfulness, and tremulous quivering motion in the lips, hands, and muscles, generally, on making any effort. The pulse, which is at first slow, becomes quick; there is a constant disposition to talk, now on one subject, and now on another. In the first variety mentioned, the pulse is full and hard, the skin dry, the delirium furious, the eyes injected, the temperature of the head increased, and the tongue is often dry, and red at its edges. In the second form, which is the most common, the pulse is small, or soft, and ranges between 100 and 120; the face is not flushed, nor the skin hot, but is covered with a clammy perspiration. As the disease advances, the mental delusion becomes constant, and is generally of a low or melancholic kind, with continued reference to the patient's ruling passions and occupations, and anxiety respecting them. He is perpetually haunted by frightful creatures, or occupied with the most extravagant ideas, and is continually endeavouring to avoid them. If a favourable change do not now take place, the skin becomes more cold and clammy, and exhales a peculiar smell, which is between a vinous and alliaceous odour; the pulse becomes still more frequent, small, weak, and thready, so that it cannot, in some cases, be counted; the general tremor increases; the patient talks incessantly, and with great rapidity; the delirium increases, and the patient either sinks into the calm which sometimes precedes death, or is carried off in a convulsive effort.

*Morbid appearances.*—The appearances on dissection give no direct information on the nature of this disease. In the true delirium tremens, the *membranes of the brain* evince but little change, the chief lesion consisting of slight opacity of the arachnoid, especially at the base of the brain. The pia mater is more or less injected, and an effusion of serum is occasionally observed in the ventricles. In those cases which have accompanied or directly followed intoxication, the vessels are often much congested, particularly those of the velum interpositum; the arachnoid is thickened, and the serum is more abundant, and occasionally is even sanguineous. The appearances of the *stomach* and *liver* are not necessarily connected with the pathology of this disease.

*Treatment.*—In the form of this disease which is attended with increased vascular action, cupping below the occiput, or leeches behind the ears, will be required; cold lotions, or cold affusion to the head, when its temperature is increased; sponging the body with tepid water; purgatives, judiciously combined with stimulants; and aperient and antispasmodic enemata. When the affection has been caused by spirituous liquors, we should assiduously watch the subsidence of the inflammatory symptoms, and anticipate the depression which ensues; with this intention, tincture of hops or of lupulin, combined with valerian or assafœtida may be given. Moderate doses of *opium*, or of laudanum, with the view of lessening nervous irritability and inducing sleep, should also be exhibited. Or tartar emetic may be given in combination with opium, with the view of quieting both nervous and vascular action.

In the treatment of the second variety, or the *true delirium tremens*, we should endeavour to cut short the disease by giving *opium*, with full doses of *camphor* and *ammonia*, and administering enemata, containing laudanum and assafœtida. Many recommend the accustomed stimulus in moderate quantity and at short intervals; it may, however, cause too violent reaction, unless the head be guarded by having frequent recourse to cold affusion. In some cases, warm spiced negus, or punch, may be allowed. The great object is *to procure sleep*, after which, the danger is over. Stimulating liniments applied over the epigastrium are occasionally very efficacious. When the symptoms of nervous irritation have been allayed, we should direct our attention to the condition of the gastro-hepatic system; in which, frequently, there is derangement of function. By the judicious combination of stimulants and medicines which will act on the liver, such as calomel or camphor, and stimulating purgative draughts, we again restore the proper secerning action of this gland, and dissipate any sanguineous injection or infarction of its structure. Having produced a proper action on the alimentary canal, we may again have recourse to opium if any signs of irritation remain. The use of opium is much abused in this disease, and in many cases it is pushed to a most unjustifiable extent. *It is an important question, In how many cases of delirium tremens does the patient die in a state of narcotism?* It is certain that the use of large and repeated doses of opium promotes the supervention of coma, effusion, and paralysis; and that its effects nearly resemble the phenomena of the last stage of delirium tremens. During the convalescence, mild tonics should be given, the diet should be light and nutritious, and a suitable beverage, in moderate quantities, allowed.

## APOPLEXY.

This affection is characterized by loss of consciousness, feeling, and voluntary motion; or, in other words, by a suspension of the functions of the brain, respiration and circulation being also more or less disturbed.*

The suspension of the cerebral functions may be connected with any of the following pathological conditions:—1. Great congestion of the brain, in which the vessels of that organ are gorged, but without extravasation of blood or serum; this is termed "*congestive apoplexy.*" 2. Congestion of the vessels of the brain, with extravasation on its surface, forming the "*meningeal apoplexy*" of Serres. 3. Hemorrhage into the substance of the brain, with lesion of its structure. 4. A serous effusion on the external surface, and into the ventricles of the brain, constituting what is defined "*serous apoplexy;*" but this is more frequently the termination of an inflammatory or congestive disorder of the brain, than of that deranged state which constitutes the apoplectic attack. 5. Apoplexy may occasion death without leaving any sign at all in the dead body. To this variety, to which the older writers gave the names *nervous*, *convulsive*, and *hysteric*, Dr. Abercrombie has applied the term *simple apoplexy.*

*Causes.*—Apoplexy is said to be hereditary. It may occur at an early period of life, but in the majority of cases the age is above fifty. Among its causes are—ossification, or aneurism of the arteries of the brain; obstruction, thickening, induration, or obliteration of the canals of the sinuses; diseases of the heart, especially hypertrophy of its left ventricle; diseases of the kidney, particularly the granular degeneration described by Dr. Bright; torpor of the liver, or other excreting glands; diseases of the air-tubes and lungs, especially those attended with violent fits of coughing; the *coup de*

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* Dr. Copland's Dictionary.

suppressed hemorrhages, particularly epistaxis and hæmor-
; suppression of the menstrual discharge; metastatic gout
eumatism; suppression of any vicarious discharge; depressed
nxious states of the mind; excessive use of wine or malt
s; too great sexual indulgence; frequent indulgence in sleep
full meal; the use of neckcloths worn too tightly around the
&c., are among the predisposing causes of apoplexy. Gastric
e, narcotics, and mephitic gases may also be enumerated.
oading the stomach and neglecting the bowels are often enough
se an attack in the predisposed.

oplexy is said to occur chiefly in persons of a full habit of
Upon this point, M. Rochoux's cases afford important data.
s sixty-three patients, thirty were of an ordinary habit of body
y-three were of a thin, meagre habit, and ten only were large
oric, and fat.*

*mptoms (premonitory)*.—Apoplexy is sometimes preceded at
lerable intervals by precursory or warning symptoms, such as
o, headache, ringing in the ears, loss of memory, a feeling of
iness and lethargy, depraved vision, or partial palsy. In some
there is a sense of great fulness in the head, the veins of the
and forehead become turgid, the countenance is suffused and
onally livid, and there are slight attacks of epistaxis. If any
dual were to complain of several of these symptoms at any
l of life, he might be regarded as on the very brink of some
s affection of the brain; and if the person be in the decline of
t may safely be said he is in immediate danger of an attack of
exy. But it is a serious error to suppose that premonitory
oms always occur; indeed, if we may trust the experience of
ochoux, one of the best authorities on apoplexy, they are by
ans common. Of *sixty-three cases* which came under his no-
*ine* only had distinct precursory symptoms.†

*mptoms of the attack*.—In the *mild* form of apoplexy (the
apoplexy of Dr. Good), the patient, after experiencing some
e premonitory symptoms, is seized with alarming vertigo, lei-
mia, or feeling of faintness; nausea and vomiting; disturb-
of the senses, particularly of the sense of sight; loss of me-
; partial loss of sense, consciousness, speech, and voluntary
n; weak, irregular, and sometimes quick pulse, and more or
f sopor.

the *more active form* (the *entonic* apoplexy of Dr. Good), the
t is more or less suddenly seized with profound sopor, the
eing either opened or closed; the breathing deep, slow, sono-
or stertorous; and the pulse slow, full, hard, or strong, some-
irregular. In this form of the disease, the above are often

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* Recherches sur l'Apoplexie, p. 214.

† Loco citato, p. 70.

the chief symptoms, there being no paralysis; but frequently the mouth is drawn to one side, the eyes are distorted, and one eyelid immoveable, with relaxation, loss of sensation and of motion of a limb, or of one side of the body; the arm of the non-paralysed side being often closely applied to the chest or to the genital organs. The patient generally lies on the paralysed side, which is relaxed, incapable of motion, and insensible to the application of irritants.

In the *most severe and sudden* forms of attack, the patient is struck down instantly, sometimes froths at the mouth, has a livid countenance, dilated pupil, complete relaxation and immobility of the voluntary muscles and limbs, and unconscious evacuation of the urine and fæces, and dies very shortly afterwards either with or without stertor, with cold, livid extremities, cold perspiration, and sometimes a cadaverous cast of countenance. This form constitutes the *apoplexie foudroyante* of the French, in which there is generally an immense extravasation of blood.

*Duration of the symptoms in fatal cases of apoplexy.*—According to the common opinion, apoplexy may prove fatal instantly, or in a few minutes. The best modern pathologists deny this, and assert that when death is so sudden the cause is commonly disease of the heart, and never apoplexy. Although, however, it seldom proves instantaneously fatal, it may undoubtedly cause death in much less than an hour. In some cases, on the other hand, patients remain even for months in a comatose, paralytic state.

*Of serous apoplexy.*—It was once supposed in certain cases not attended with evidence of vascular excitement, that the symptoms were owing to an *effusion of serum;* hence they were called serous apoplexies; but this distinction is now abandoned.

*Diagnosis between serous and sanguineous apoplexy.*—The sanguineous was said to be distinguished by flushing of the countenance, and strong pulse, and by occurring in persons in the vigour of life; the serous, on the other hand, was said to attack the aged and infirm, the countenance being pale, and the pulse weak, in such cases. But there are many cases whose symptoms and circumstances come exactly within the description of the *serous apoplexy*, but still after death present the vascular engorgement, &c., of the sanguineous, whilst no serous fluid is effused. Speaking of these distinctions, Dr. Abercrombie observes, "It will be found that many of the cases which terminate by serous effusion, exhibit in the early stages all the symptoms which have been assigned to the sanguineous apoplexy; while many of the cases which are accompanied by paleness of the countenance and feebleness of the pulse will be found to be purely sanguineous."

*Morbid appearances.*—Effusion of blood within the cranium may **take place in the brain or cerebellum; in their crura;** in the pons

Varolii, and in the medulla oblongata; in the corpus callosum; i the ventricles; on the surface of the brain beneath the pia mater in the cavity of the arachnoid; between this membrane and the dur mater, which it lines; and between the dura mater and cranium.

It has been found that certain parts of the brain are much mo liable to sanguineous effusions than others.

### M. ROCHOUX'S DISSECTIONS.—FORTY-ONE CASES.

| | |
|---|---|
| Extravasation of blood on the *left side* | 18 |
| Do. do. *right side* | 17 |
| Do. do. *both sides* | 6 |
| | 41 |

### OF THE SITUATIONS OF THE EFFUSIONS.

| | |
|---|---|
| In the corpora striata | 24 |
| optic thalami | 2 |
| In both these situations | 1 |
| Under the corpus striatum | 1 |
| In the middle of the hemispheres | 5 |
| posterior part of the ventricles | 2 |
| anterior and interior part of the hemisphere | 2 |
| posterior and interior part | 3 |
| middle lobe | 1 |
| | 41 |

By this table it is shown that out of forty-one cases of effusio twenty-eight were in the corpora striata and their vicinity.

### A SUMMARY OF THE RESULT OF 386 CASES OF APOPLEXY, FROM THE PREC D'ANATOMIE PATHOLOGIQUE OF ANDRAL.

### SEATS OF THE EFFUSION.

| | |
|---|---|
| In the substance of the hemispheres, on a level with the corpora striata and optic thalami | 202 |
| corpora striata | 61 |
| optic thalami | 35 |
| hemispheres above the centrum ovale | 27 |
| lateral lobes of the cerebellum | 16 |
| brain, anterior to the corpus striatum | 10 |
| meso-cephalon | 9 |
| spinal cord | 8 |
| posterior lobes of the brain | 7 |
| middle lobe of the cerebellum | 5 |
| peduncles of the brain | 3 |
| olivary bodies | 1 |
| peduncles of the cerebellum | 1 |
| pituitary gland | 1 |
| | 386 |

On reference to this table, it will at once be observed the va preponderance of cases in which effusion has occurred into the hemispheres of the brain, the corpora striata, and the optic thalami.

*Treatment.*—In the treatment of apoplexy, with active determination to the head, full labouring pulse, carotids beating strongly, &c., the first indications are to relieve the head from the accumulation of blood, to prevent further congestion, and to obviate inflammatory action: and for these purposes the only efficient means is *bleeding.* A full bleeding, then, must be immediately employed; the head should be shaved and freely leeched, and the patient may be cupped on the temples or the back of the neck. The administration of brisk *drastic cathartics* is attended with the best results, their *derivative* action being a powerful means of relieving the coma. Croton oil is the purgative generally used in these cases; but where the patient can swallow, other drastic cathartics may be given. Where the patient has completely lost the power of deglutition, the croton oil should be mixed with a little castor oil or mucilage, and passed into the œsophagus by means of an elastic tube. Drastic *enemata* will also be found beneficial. The head must be kept cool by means of *cold lotions, iced waters,* or by pouring a small stream of cold water on the scalp occasionally. When the coma is persistent, *blisters* should be applied to the nape of the neck, or to the head; sinapisms to the feet are also indicated. But it must yet be remembered that there is injury done to the brain; that a portion of its substance has been torn up, and compressed by a clot of blood; and that this injury has to be repaired. Hence, the indiscrimate use of the lancet, draining the patient's veins after all active congestion has ceased, is much to be reprobated. Something must be allowed to time, and the powers of nature.

If the patient's face is cold, the carotids beating feebly, and the patient approaching a state of syncope, considerable caution must be used in abstracting blood. Purgatives should first be given, with small doses of ammonia, and sinapisms be applied to the feet; when the circulation has recovered its force, blood may be taken by cupping from the nape of the neck, and blisters be applied behind the ears, or to the nape of the neck.

When an attack of apoplexy is known to follow habitually if the stomach is loaded with indigestible food, an emetic of sulphate of zinc may be given, as it evacuates the stomach with the least possible straining.

## PARALYSIS.

The most characteristic symptom of cerebral hemorrhage is paralysis. Very slight effusion produces this effect, and in general its intensity is in the direct ratio of the extent of the effusion. Paralysis may also arise from diseases of the brain, or its membranes, injuries of the brain or the spinal cord, diseases of the spinal cord derives still less support from actual experience than the former, for blood may be effused in the anterior lobes of the brain without giving rise to any modification of speech.

The best established facts regarding the seat of cerebral hemorrhage, and the relation which exists between it and paralysis, are the following:—

1. That the paralysis almost always occupies the side of the body opposite to that of the brain or cerebellum in which the effused blood is situated.

2. That the paralysis affects only one side of the body when the effused blood is confined to one hemisphere of the brain, or one of the lateral lobes of the cerebellum.

3. That the paralysis exists on both sides of the body when the hemorrhage has taken place in both hemispheres of the brain, or both lateral lobes of the cerebellum, into the ventricles, the pons Varolii, the medulla oblongata, and on the surface of the brain.

4. That paralysis of both sides of the body may also take place when the hemorrhage is confined to one hemisphere of the brain or lateral lobe of the cerebellum, but is so extensive as to produce compression of the opposite hemisphere or lobe.

A most remarkable circumstance, connected with cerebral hemorrhage, has been observed by Andral, viz., hemorrhage of one of the lobes of the cerebellum, like that of one of the hemispheres of the brain, gives rise to paralysis of the opposite side of the body; but if hemorrhage takes place into the *left* lobe of the cerebellum, and *right* hemisphere of the cerebrum, the paralysis is found to exist on that side opposite to the hemisphere of the cerebrum, which is the seat of the effusion, the other side remaining unaffected by the effusion in the cerebellum.

When blood is effused into the substance of the brain, its colour gradually changes from red to black, and in successive transitions to brown, dull green, orange, pale yellow, or yellowish white. When the clot has undergone the latter changes of colour, and the fibrine, separated from the other constituents of the blood has assumed a fibrous or laminated appearance, the blood-vessels are observed to form in it. The fibrine may retain its distinctive characters for some time, and then become converted into firm fibrous tissue, which, gradually diminishing in bulk, forms eventually a small cicatrix; or, the organized fibrinous substance may be converted into a loose cellular tissue, filled with a serous fluid (the *apoplectic serous cyst*), and traversed by a considerable number of blood-vessels. Should the case, under these circumstances, proceed favourably, the serum of the cyst becomes absorbed, the walls approximate, and a cicatrix is formed. Finally, if a complete cure of the paralysis is effected, the cicatrix, whether formed by the first or last process described, disappears.

shooting towards the spine, and then of the muscles of the face and trunk, which become more or less permanently rigid and hard. Besides this rigidity, there are paroxysms of spasm, alternating with partial relaxation; these spasms gradually increase in violence and duration, and produce excessive pain; they are brought on by the slightest cause.

The *voluntary* muscles appear to suffer most; but the involuntary are also affected towards the close of the disease.

Nearly all the *functions* suffer. Deglutition is more or less difficult; the bowels are constipated; respiration is embarrassed, sometimes so much as to cause death from apnœa. Spasm of the glottis often occurs; the action of the heart is accelerated. There is no fever, though the temperature of the surface is elevated several degrees above the usual point. The mind continues remarkably clear throughout the disease. Death may occur from the first to the fifth day, either from apnœa, arising from spasm of the glottis, or immobility of the respiratory muscles, from pure exhaustion, or possibly from spasm of the heart.

A particular variety of tetanus occurs in new-born children, called *trismus nascentium;* it is especially common in the West Indies among the negroes, and is usually ascribed to irritation arising from cutting the cord, though doubtless owing to some predisposing cause, as foul air, &c.; it is always fatal.

*Nature and cause.*—Tetanus is the result of an irritation of the spinal centres, whether originating therein, or reflected thereto from the nervous extremities; the latter is the most usual condition, as when a splinter inserted under a fascia transmits the irritation to the spinal centres, from which the motor force is sent into the various muscles involved in the spasm. *Inflammation* is certainly not the cause; for in true spinal inflammation we have the opposite result, or *paralysis*. Frequently there is no lesion of the nerve-centres discoverable after death; though, in other instances, there are marks of inflammation or congestion in the meninges of the spinal marrow, and also in the nerves proceeding from the wound. There must also, it would appear, be a peculiar predisposition, since comparatively few of those who are exposed to the exciting causes, are attacked with the disease. It is not known in what this predisposition consists; but it is favoured by the long-continued prevalence of heat, and hence is much more common in tropical countries. Males are more liable to it than females; and the age most exposed to it is from ten to fifty.

Of the *exciting* causes, may be enumerated wounds and injuries, particularly lacerated and punctured wounds, meningeal inflammation, nux vomica or strychnia; and, of the idiopathic, exposure to cold when the body is heated.

*Treatment.*—The traumatic form is much the most dangerous. The indications are:

1. *To remove all known causes of irritation.*—As by the application of an anodyne emollient poultice to the wound, &c.; clearing out the bowels by stimulating cathartics; bleeding, if it is accompanied with inflammation.

2. *To diminish the susceptibility of the nervous centres,* by *very large* doses of opium, or the extract of Indian hemp. *Belladonna ointment* applied endermically to the spine is asserted to have proved effectual after other remedies failed.

3. *To diminish directly the nervous irritation* by the use of tobacco enemata, or the tincture or extract of aconite internally; the cold bath; or by powerful revulsives, or ice applied to the spine; Dr. Hartshorne recommended a solution of caustic potassa (ʒij in f℥iv of water).

4. *To support the patient's strength,* by nutritious diet and cordials.

In consequence of the closure of the jaws, the food must be introduced, in a liquid state, either between the teeth, or, if necessary, by removing one or more of them; and in case of inability to swallow, through the stomach-tube.

## EPILEPSY.

*Causes.*—Epilepsy appears to be occasionally hereditary, but it is more frequently an acquired disease. It generally arises from excessive nervous irritation, either induced by sympathetic influences, or by direct causes. As examples of the former, may be enumerated, gastro-intestinal disturbance from indigestible food, worms, &c.; difficult dentition; uterine irritation; excessive sexual intercourse and masturbation; the abuse of spirituous and fermented liquors; the presence of calculi in the kidney, ureter, or bladder, or of gall-stones in the excretory duct of the liver. The direct causes are—injuries of the head or spine; diseases of the cranial bones or of the vertebræ; tumours growing on the bones, or spiculæ of bone protruding into the brain; ossific deposition in the dura mater or its processes; ossification of the arteries of the brain; concussions of the brain or spinal cord; and metastasis of gout or rheumatism to the encephalon. Dr. Meade is convinced that the relative frequency of disease of the spinal cord and its membranes in this affection is underrated; and that much may be done for the patient in many instances by attending to the state of this part of the nervous system. The other causes which have been enumerated are—fright, fits of passion, distress of mind, appalling sights, seeing others in the paroxysm, excessive hemorrhage, immoderate depletion, hypercatharsis, the suppression of eruptions, irritation of remote nerves, and the syphilitic and mercurial poisons. Its causes may be divided into, 1st, the *centric*, consisting of disease, or causes of irritation in the nervous centres; 2d, the *eccentric* or *peripheral*, consisting in causes of irritation in the viscera or external parts.

*Symptoms.*—Epilepsy is generally a chronic disease, and frequently ends in insanity; it sometimes, however, proves fatal during a paroxysm. It consists in fits of *unconsciousness* and *convulsions.* The epileptic fit is *occasionally preceded by certain warnings*, such as stupor, a sense of coldness, or creeping, or of a gentle breeze *(aura epileptica)* proceeding from a particular part of the body towards the head. M. Georget states, "that warnings do not occur in more than five cases in a hundred;" this is, however, underrating their frequency.

In most cases, the patient utters a cry and suddenly falls senseless; the eyes are opened widely, the pupils are fixed, the face is drawn to one side, and the jaws are firmly closed; after some minutes, the muscles of the neck become rigid, the jugular veins distended, and the face is in a state of livid turgescence; the muscles of the face are now seized with frequent spasmodic contractions; there are convulsive movements of the extremities, particularly the superior; the thorax is fixed and the respiration is exceedingly difficult. The tongue is sometimes thrust with violence out of the mouth, and is occasionally caught between the teeth, and severely bitten; in this case the frothy matter expelled from the mouth is tinged with blood. To this state, which may last from a few minutes to a quarter, or even half an hour, succeeds a deep sleep, general relaxation of the muscular system, paleness of the countenance, and a gradual return of free respiration; the countenance for some time retains an expression of stupidity; the intellectual and sensorial faculties, however, gradually resume their activity, the patient at the same time experiencing a creeping sensation all over his body. Occasionally it happens that one fit succeeds another, till the patient becomes comatose, and dies; but comparatively few die during a fit, unless the disease has existed for a considerable time. In some cases, the attack is much less violent, and consists merely of a momentary loss of sense, with slight and partial convulsions of the eyes, mouth, upper extremities, or fingers, and may or may not be accompanied by a fall.

The most frequent *complications* of epilepsy are, apoplexy, mania, paralysis, chorea, hysteria, and catalepsy; hence the morbid appearances are infinitely various.

*Morbid appearances.*—Epilepsy may be connected with any of the organic lesions which occur in the brain and cranium. When a patient dies in a fit of simple epilepsy, the substance and the membranes of the cerebrum and cerebellum are found gorged with black blood. In complicated cases of epilepsy, especially with mania, the

ary substance of the brain is found indurated, and its vessels
ed; occasionally, however, with dilatation of its vessels, it is
d and flabby. These structural changes are generally limited
nt. The cortical structure also occasionally presents evidence
onic inflammation, and is, in some instances, adherent to the
ranes. The medulla oblongata and spinal cord present, in
cases, alterations similar to those found in the encephalon.
enzels found the *pituitary gland* and *infundibulum* variously
in colour, size, and consistence, in nearly all the cases of
sy which they examined; and the crista galli of the ethmoid,
e clinoid processes of the sphenoid bone, more or less promi-
or otherwise changed in position and shape, in most of them.
larger proportion of cases, the *pineal gland* was also changed
our, and softened. Caries, thickening, internal exostoses,
, malformations, and malpositions of the bones at the base of
ull, with various changes of the membranes, were met with in
ger proportion of cases. The heart, pericardium, lungs, liver,
dneys, have been found diseased in rare instances.

*atment.*—But little can be done for the patient during the
ysm, except placing him in the horizontal position, and pre-
g his being injured by the violence of his muscular exertions.
the first things to be done is to put something between the
to prevent injury to the tongue, and the dress must be
ed, particularly stays and neckcloths. *Bloodletting* has been
mended in the paroxysm; but unless the fits are attended by
d plethora or cerebral congestion, or in the first attack, espe-
when produced by the suppression of some sanguineous evacu-
it should be deferred. It is in the convulsive stage of the
ysm that bleeding is particularly indicated; it cannot, how-
be easily performed in this stage. *Cold affusion* to the head
en recommended by Brera; it is not very efficacious, except
se cases complicated either with hysteria or uterine disease.
*asmodic* and *purgative enemata* are perhaps the most effica-
means during the fit; if there be not much determination to
ad, assafœtida injections and castor oil may be employed; but
this symptom is present, turpentine should be preferred.

r the paroxysm is over, the patient should be kept quiet, the
opened as quickly as possible, and light nourishing diet in
ate quantity is to be used; the abuse of stimulants is to be
ed from; and every cause, corporeal as well as mental, which
ssibly have the effect of disturbing the balance of the circula-
or exciting the nervous system, is to be avoided. If there be
e of much disturbance in the cerebral circulation, the treat-
ust be more active; if the patient's strength will admit of
*ral bleeding* from the arm may be useful, or occasional *cup-*
ay be had recourse to, together with keeping the head shaved,

applying cold lotions, acting briskly on the bowels, and placing moxas or blisters behind the ears, or setons in the neck. In this form of the affection, Dr. Cheyne recommends *James's powder* to be taken at bedtime, beginning with two or three grains, and increasing the dose every night, until a sensible effect is produced on the skin, stomach, or bowels. When chronic inflammatory action is suspected, the *tartar-emetic ointment* should be applied along the spine, or over the nape of the neck, until it produces a copious eruption of pustules. Where this disease arises from an affection of the spinal cord or its membranes, it will necessarily require either vascular depletions or tonics, or both, according to the degree in which plethora, increased action, or deficient power, is inferred to be present. Where incited action exists, cupping, the application of leeches, and dry cupping in the course of the spine, the insertion of setons or issues a little below the seat of the pain, or application of moxas, are the most efficient means. The effects of these means are increased by absolute rest, the antiphlogistic regimen, and active purges. In some cases, associated with deficient power, whilst moderate local depletion, dry cupping, external derivation, &c., are resorted to, *tonics* and *antispasmodics*, such as valerian, castor, myrrh, cinchona, camphor, and the preparations of iron, should be prescribed. This state of disease is often induced by masturbation; in which case cold aspersion of the genitals night and morning, sponging the spine with cold salt water or vinegar and water, and the internal use of the preparations of iron, will prove beneficial. Where epilepsy occurs in a scrofulous habit, the iodide of iron, or the iodide of potassium, may be given. If worms be suspected, turpentine and other anthelmintics must be exhibited. The diseases of the digestive organs, and the other complications of epilepsy, should be treated on general principles.

Some medicines have been much lauded in the treatment of epilepsy; the principal of these are—the nitrate or oxide of silver, the ammonio-sulphate of copper, arsenite of potash, sulphates of iron, zinc, or copper, quinine, extract of nux vomica, and strychnia. Among the antispasmodics employed are, ether, ammonia, camphor, musk, castor, assafœtida, galbanum, valerian, and serpentaria.

## CHOREA.

This disease is popularly named St. Vitus's dance, *Chorea Sancti Viti;* the French call it the dance of St. Guy; and the Germans, the dance of St. Weit.

*Exciting causes.*—The most common are, intestinal irritation from worms or morbid accumulations, and fright. It may also be caused by injuries to the nervous system from blows or falls; by suppression of eruptions, or vicarious discharges; by rheumatic

sis to the membranes of the spinal cord; by violent mental
ns; by excessive venery; by masturbation, &c.

*ptoms.*—Generally speaking, convulsive movements, or rather
s, of the fingers and muscles of the face are first observed;
short time, the convulsive movements become more marked;
contortions of the features take place; the disease extends
voluntary muscles of all parts of the body, and frequently
f the lower extremities are so continually excited that the
appears to be dancing, which makes his gait very unsteady;
hiefly affected when he is most desirous to control his actions.
sease is sometimes confined to one side of the body, or to a
part, as the face, a leg, or an arm; the muscles are also
l with a sensation of pricking, creeping, or of numbness. At
ere is no constitutional derangement, there being no fever,
the functions being properly performed, with the exception
bowels being torpid; but after the disease has continued
ime, the general health becomes impaired, and occasionally
ntal faculties suffer. This affection is much more common in
nale than the male, the proportion being, according to the
thorities, three of the former to one of the latter. It most
ntly appears between the age of seven and fifteen.

*nature of the disease* is but very little understood; by several
it is attributed to inflammatory action of some part of the
-spinal axis; most probably it is due to some perverted action
*cerebellum.*

*seat* of this disease is quite as obscure as its nature. M.
considers the *corpora quadrigemina* to be the seat of chorea,
MM. Bouillaud and Magendie conceive that it is seated in the
*llum*, the functions which they ascribe to this organ being
hiefly affected in this disease.

*atment.*—This consists in removing morbid secretions and
ccumulations; in subduing, when evidently present, excited
of the vessels of the spinal cord or brain; and, finally, in
g the energy of the nervous system. *Purgative medicines*
een prescribed with the best effects in this disease; a full
f calomel should be given at first, and in a few hours after a
cathartic ought to be exhibited. Calomel and jalap are a
n combination in this disease; and Dr. Hamilton recommends
pills on the days when these are not employed. The com-
infusions of gentian and senna, with a little sulphate of
sia, may be given in the morning occasionally. The oil of
tine also forms an excellent medicine in chorea, and is parti-
indicated where the presence of worms is suspected. The
ould be light and nourishing; every indigestible substance
be carefully avoided. Dr. Wood recommends the use of

black snake-root, having frequently found it of itself adequate to the cure of the disease.

If there be evidence of cerebro-spinal irritation, our attention must necessarily be directed to its removal; this is best effected by cupping, leeches, and powerful counter-irritation, over the parts particularly implicated. Attention to the mental emotions, warm woollen clothing on the lower extremities, cold affusion on the head or on the spine, or the shower-bath, constitute important parts of the treatment.

Boys are said to be more easily cured than girls. In obstinate cases, tonics must be employed, and those generally used in this disease are, bark, sulphate of quinine, arsenical solution, nitrate of silver, sulphate of zinc, the preparations of iron, and the ammonio-sulphate of copper; of the efficacy of the last substance, Dr. Burns speaks highly. The experiments of M. Baudelocque, at the Children's Hospital, Paris, demonstrates that the disease may generally be cured by a persevering use of sulphur-baths. Baron Dupuytren employed cold affusion with much success. The same mode of treatment has been found very efficacious at the Hôpital des Enfans Malades.

## HYSTERIA.

This is an apyrexial convulsive disorder, affecting females almost exclusively. The seat of this disease is altogether unknown.

*Symptoms.*—Hysteria is an intermittent, irregular, chronic disease, which comes on by fits, and usually attacks females from the age of puberty to the critical period; it very commonly occurs on the suppression or diminution of the menses, particularly in persons of a nervous or irritable temperament. In the slighter forms, the patient, without any assignable cause, bursts into a fit of weeping, which perhaps is soon followed by convulsive laughter, which may last for a few minutes; and before composure takes place, the patient gives several loud sobs; one of these fits may succeed the other, till the patient falls asleep. The fit sometimes begins with a yawning, numbness of the extremities, involuntary laughing and crying, alternations of pallor and redness of the face, and a sensation as if a ball (*globus hystericus*) commencing at the hypogastrium, ascended through the abdomen and thorax to settle at the throat, where it produces a violent sense of constriction, and of impending suffocation. In more severe instances of hysteria, there are convulsive movements, particularly of the hands, face, jaws, and muscles of respiration; they are of a clonic character. The pupils are dilated; and occasionally the paroxysm has a close resemblance to epilepsy, only that the insensibility is rarely complete. In this disease there is a remarkable deficiency of the organic matters in the urine, and this fluid is very watery. Hysteria does not tend essentially to increase, nor does it determine as a consequence mania or idiocy. Hysteria is very apt to be confounded with epilepsy.

*Treatment.*—In those cases where there is reason to suspect an congestion or inflammation of the uterus, or of any portion of th brain, then blood should be drawn by cupping from the back of th head or loins. During a paroxysm, the stays and all tight string should be loosened, and the free admission of air procured; the fac is to be sprinkled with cold water, volatile salts are to be held to th nostrils, and, if the patient can swallow, a drachm of the aromati spirit of ammonia, or the same quantity of ammoniated tincture o valerian, may be given in a wineglass-full of water. In the severe forms of the disease, the application of cold to the body is often most effectual means of putting a stop to the paroxysm. The bowel should be kept regularly open, and the best purge in these cases i castor oil with oil of turpentine, given every, or every second morning, according to circumstances; enemata containing assafœtida ar also useful. If the convulsion is very protracted, it will be prope to examine the spine, and, if found tender, to apply cups to it. Th nauseating effects of tartar emetic are also very beneficial in thi condition. The prevention of the recurrence of the symptoms is t be attempted by keeping up an action on the bowels, and administering tonics, such as the sulphate of quinine, the preparations o iron, &c. Fœtids, such as assafœtida, castor, valerian, &c., ar sometimes, but not invariably, useful. The menstrual action, if irregular, must, if possible, be rectified by appropriate means. Th diet should be light, and every attention paid to the improvemen of the general health.

THE END.

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